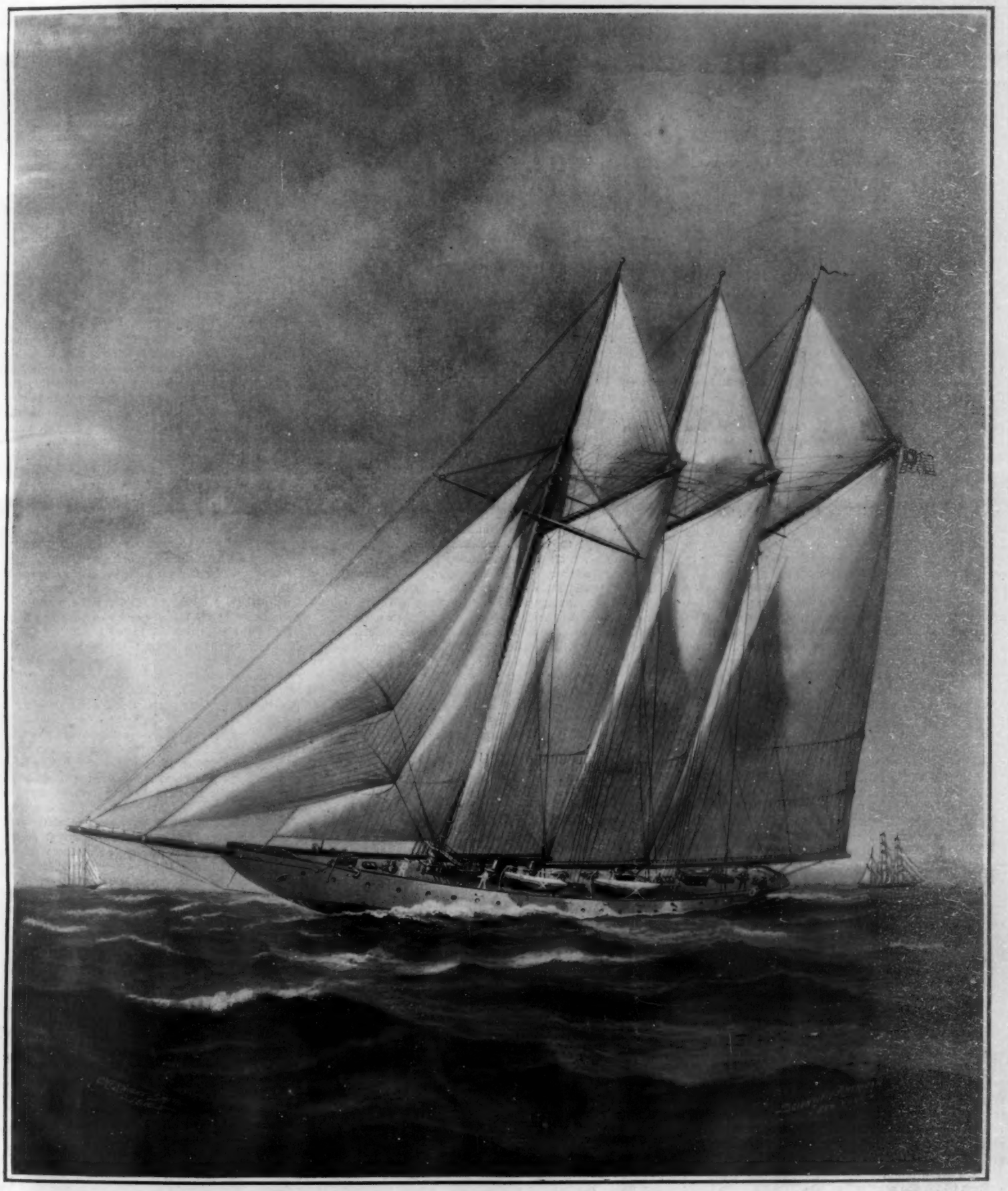
SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1910, by Munn & Co., Inc.]

A POPULAR ILLUSTRATED WEEKLY OF THE WORLD'S PROGRESS

Vol. CIII.—No. 15. ESTABLISHED 1845. NEW YORK, OCTOBER 8, 1910. [10 CENTS A COPY. $3.00 A YEAR.



This yacht, now under construction for next season's racing, is 198 feet 6½ inches long on deck, 33 feet 8½ inches broad, and carries 150 tons of lead on her keel.

"KARINA," THE LARGEST OF THE RACING SCHOONERS.—[See page 274.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO., Inc., - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

CHARLES ALLEN MUNN, *President*
361 Broadway, New York.

FREDERICK CONVERSE BEACH, *Sec'y and Treas.*
361 Broadway, New York.

TERMS TO SUBSCRIBERS.

Subscription one year $3.00

Postage prepaid in United States and possessions Mexico, Cuba and Panama.

Postage to Foreign countries ..... $1.50 per year extra.

Canadian postage ..... .75 per year extra.

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (established 1845) ..... $3.00 a year
Scientific American Supplement (established 1876) ..... 5.00 "
American Homes and Gardens ..... 3.00 "

The combined subscription rates and rates to foreign countries, including Canada, will be furnished upon application.

Remit by postal or express money order, or by bank draft or check.

MUNN & CO., Inc., 361 Broadway, New York.

NEW YORK, SATURDAY, OCTOBER 8th, 1910.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

RUNNING A RACE WITH CHANCE.

WITH the last doubt removed that Wellman is seriously attempting to make the passage of the Atlantic with his airship, we can only say that he and his associates are running a race against chance and accident, with the odds heavily against the dirigible.

At the same time, it is only just to acknowledge that, in preparing this aerial ship for its venture, Mr. Vaniman, the designing engineer, has shown an uncommon amount of foresight and inventive and constructive skill. Technically considered, the Wellman airship is at once an interesting and instructive study; and it was for this reason, and not because we have any faith in the ultimate success of the venture, that we gave it, in our last issue, an unusually complete illustration and description. Mechanically considered, the ship is well designed for its tremendous task, failure to accomplish which will be due either to the stress of wind and weather or to one of the many accidents to which any new and untried mechanism, such as this, is liable. Failure through weather conditions can scarcely be provided against, although the sponsors of the expedition claim to have made every reasonable provision; but failure due to the total lack of preliminary trying out and tuning up can only be chargeable to inexcusable neglect; and it is just here, we think, that the chief peril of this most extraordinary undertaking lies.

It is well understood in mechanical engineering that no matter how well designed and carefully built a new machine or plant may be, it is necessary to put it through a more or less extended series of tests to determine points of weakness and bring it up to a basis of thoroughly reliable operation; and in such a complicated machine as this Wellman dirigible, which involves several new and untried principles and appliances, the demand for a preliminary period of trials, extending over several weeks, would seem to be imperative. Mere shop or shed tests are not sufficient. The ship should be taken out and sent over the ocean on extended cruises under varying conditions of weather; so that its curious snake-like equilibrator may be tested alike over waters that are absolutely calm and over giant ocean combers that are rolling from twenty to thirty feet in height. Nothing of the kind, however, has been done.

We repeat that, structurally considered, the machine is an excellent piece of work. The double-tube truss terminating in the long, cylindrical fuel tank as a bottom chord is a construction at once shipshape and serviceable. Moreover, the provision of a broad lateral truss, placed close up against the body of the balloon, and securely fastened thereto, shows good designing. Very ingenious and well worked out is the arrangement for changing the relation of the axis of the propeller shafts to the axis of the ship. This, in conjunction with the provision of ballonets at each end for moving the center of lift of the hydrogen gas, should give a quick and powerful control of fore-and-aft stability.

The most original feature of the machine, the one against which the practical mind will set a large query mark, is the long and heavy equilibrator, by means of which it is planned to maintain the balloon at a chosen height above the surface of the water. In calm weather and steady breezes it is probable that the device will operate satisfactorily; but should the airship be caught in a sixty-mile gale (in which case, the propellers being in operation for steerage purposes the speed over the water would not be less than 60 to 65 miles an hour) the drag of the equilibrator must necessarily become very great; and being applied at the center of the ship, must inevitably, as more or less of the rope is immersed when riding on the crest or in the trough of the waves, set up a fore-and-aft lurching effect upon the vessel. However, Mr. Vaniman hopes to overcome this tendency to "nosing" by the combined effect of the ballonets, the shifting of the axis of the propellers, and the righting effect of two capstans, hauling one on the fore and one on the after end of the sling cables to which the equilibrator is attached.

To the conservative mind, the projected trans-Atlantic air voyage appears to be foolhardy in the extreme. However, we have crossed the Atlantic from west to east, when for the five days of the trip the winds were steady and the sea was as calm as the proverbial mill pond. If the voyagers are favored with such conditions, it is conceivable that they may get across. Should they do so, the voyage must certainly be set down as in every way the most extraordinary feat of transportation of this or any other age.

BURSTING OF 12-INCH GUNS.

THE recent bursting of a 12-inch gun on the battleship "Georgia," flagship of the third division of the Atlantic fleet, while she was leading a column in battle practice off the Virginia Capes, is the latest of a series of similar accidents which, to say the least, are extremely disconcerting. Accidents of this character had already occurred in the main battery of the "Iowa," "Ohio," and "Missouri."

The wrecked gun was the port gun of the forward turret, and about 15 feet, or the whole of the forward portion of the chase extending from the front end of Hoop No. 1 to the muzzle, was blown entirely away. It is one of the unfortunate features of accidents of this character that their immediate cause is left in considerable obscurity. The failure may be due to the powder, to weakness in the gun, or to a combination of both. In all probability, the last explanation is the true one. The gun which failed is one of a type in which the hoops do not extend over the full length of the gun to the muzzle, and it is evident that at the point where the last hoop ends, there must be a sudden drop in the tangential strength of the gun, in its ability to withstand bursting stresses. Theoretically, not only should there be sufficient strength at this point to resist the normal pressure due to the gases which are given off by the so-called slow-burning powder, but there is supposed to be sufficient metal to take care of a considerable rise of pressure above the normal, due to irregularity, or a sudden jump in the powder pressure. In the latest type of gun, such as has been mounted on the vessels of the dreadnought class, Hoop No. 1 has been extended entirely to the muzzle, an improvement which greatly fortifies the gun, both against bursting and against that tendency to droop which caused so much trouble in the earlier days of the manufacture of hooped guns.

It is the endeavor of the chemist in drawing up a formula, and of the powder factory in manufacturing the powder, to produce an explosive which instead of being converted into gas almost instantaneously in the powder chamber (as was the case with the old black powder), will burn relatively so slowly that the initial pressure in the powder chamber will be relatively low and the combustion will be maintained at such a rate that the volume of gas, as it is given off, will be sufficient to maintain a high average pressure on the base of the shell during the whole of its travel down the bore to the muzzle, the last particle of the powder being consumed before the shell leaves the gun.

Now it is evident that such a powder, by raising the average pressure will call for the provision of extra material in the chase of the gun, and any one who is familiar with the history of gun construction will remember how the hooping has gradually been extended over the chase until, as we have noted above, it reaches, in the latest guns, clear up to the muzzle. In all probability the immediate cause of the accident was a sudden increase of pressure, due to a too fierce combustion of the powder and its sudden change from the solid to the gaseous condition. If the powder pressure were graphically represented by a line falling from the powder chamber to the muzzle, it would probably be found that in the case of the wrecked gun on the "Georgia," there was a sudden rise in this line just before or at about the point where the hooping of the gun terminated.

This irregularity in the powder might be due to some chemical deterioration, or possibly to the breaking up of the powder grains. This would suddenly expose a much larger area for combustion (smokeless powder burning only on the surface) and there would be immediate liberation of a proportionate amount of gas with a resulting sudden rise in pressure.

OUR RAPIDLY-GROWING RAILROAD SYSTEM.

ALTHOUGH we all of us recognize the immensity of the railroad system of the United States, it is not so generally understood that its growth is also on a stupendous scale. Evidence of this is found in the fact that during last year there was added to the existing railroads of this country a length of steam road which is equal to about one-fourth of the whole of the existing steam roads of Great Britain, the increase for the year being 6,310 miles. The total length of railroad in the whole country on December 31st, 1909, according to Poor's Manual of Railroads, was 238,356 miles, as against 232,046 miles at the close of 1908.

The capital stock of the railroads has reached over eight billion dollars, and the bonded debt is above nine billion. These, with minor liabilities, bring up the total liabilities to the huge sum of over twenty billions of dollars. The total cost of railroad and equipment is fourteen and a half billion dollars. The total earnings from passenger traffic were, in round numbers, $578,000,000, and from freight traffic, $1,720,000,000. These, with other sources of revenue, brought up the total gross earnings to $2,513,000,000. The net earnings were $852,000,000, and the total net income was $1,018,041,837. The total number of passengers carried on the whole system was 974,423,075, and the revenue per passenger mile was 1.934 cents. The total freight moved amounted to 1,635,215,800 tons, the revenue per ton mile being 0.757 cent. The significance of these statistics as a measure of the development of the country is undeniable. They suggest, if they do not actually prove, that the so-called depression in business must be due to causes that are transient and of secondary importance.

AN IRRITATING REQUIREMENT IN PATENT OFFICE PROCEDURE.

THE Department of the Interior has issued an order to the heads of the various bureaus and offices of which it is composed, directing first that "firms of attorneys or agents, as such, will not be admitted to practice before this Department . . . in any proceeding or matter involving the services of an attorney or agent; and in the presentation of any matter by any such firm, it must be represented by one or more duly qualified members thereof in his or their own proper person." The order further provides that firms of agents or attorneys may file powers of attorney from clients as evidence of authority, but the power when filed must be accompanied by *an appearance* in that behalf in writing, signed by one or more duly qualified members of the firm. All subsequent documents filed in the presentation of any case by the firm must be similarly signed. The Department further threatens with disbarment a firm which receives into membership any person who has been disbarred or suspended from the practice of the Department of the Interior or its bureaus or offices.

So far as it affects practice before the Patent Office, the first mentioned new order accomplishes no useful purpose. It throws upon a firm of practitioners the laborious duty of signing many papers, with the result that an attorney whose time should be spent in protecting his clients' interests is compelled to fritter away a large portion of it in making a signing machine of himself. In the preparation of patent papers, the new order entails much irksome work, because of the number of papers in a case and because of the length of time which frequently elapses between the filing of an application and the final grant of a patent. There are cases enough in the Patent Office which have been pending for years. The number of amendments filed at frequent intervals may amount to several dozen. According to the new rule, every one of these papers must be signed either by the particular member of the firm to whom the case was originally intrusted, or by the firm itself, as the case may be.

It is rumored in Washington that the order is the outcome of a land fraud case, which was brought to light by the Ballinger controversy. Should that prove to be the case, it is difficult to understand why all the bureaus of the Department of the Interior should be constrained to meet the peculiar conditions which prevail in the Land Office. No department of the government conducts its business so painstakingly as the Patent Office. No body of solicitors, as a whole, conduct their business as efficiently and as honestly as patent attorneys. It is true that there are some attorneys who have incurred the displeasure of the Patent Office by methods which can not be regarded as professional; but the rules are so stringent and the Commissioner so vigilant, that sooner or later a firm whose methods are discreditable must be driven to the wall.

That section of the Department of the Interior's order which forbids a firm practising before the Department to receive in membership a person who is disbarred, seems fair and desirable. Still, how can a disbarred attorney be prevented from practicing as an employee, at a salary fully equal to his share of profits as a member of the firm?

ELECTRICITY.

We are frequently astonished by the abnormally long range of wireless telegraph stations. Such equipments as commonly have only a hundred miles radius, on occasion are able to send messages a thousand miles. This matter was recently discussed in a German paper, and it was pointed out that such long ranges always occur after dark, and hence are probably due to the fact that the atmosphere is not ionized at night to the extent that it is in the daytime.

In a paper recently published in the London Electrician, there is a discussion of electric traction in London between Victoria and London bridges. The single-phase system is used here, and this has proved more economical in the consumption of energy than the direct-current system. The consumption of energy is 70 to 80 watt hours per ton mile, as against 90 to 100 in the case of the direct-current system. There has been no trouble whatever with the overhead work.

The battleship "Nebraska" is to be fitted with a telegraph typewriter system which should be particularly valuable in time of battle for communication between the conning tower and the gun positions. The advantage of this system over the telephone is obvious. In the noise of battle, directions can be heard only with the greatest difficulty, whereas with the typewriter telegraph orders are received in printed form and can readily be understood. Just how such a system would operate when subjected to the jars incidental to gunfire, is a matter which can only be determined by experiment.

A novel vacation trip was described in a recent issue of the Electric Railway Journal. It consisted in an electric railroad tour from New York to Milwaukee. The trip, except for the use of a boat on the Hudson from Tarrytown to Hudson, and the steam railroad from Fonda to Little Falls, was made entirely by electric cars. The entire distance traveled, including a number of side trips, amounted to 1,986 miles, and the total cost was $33.50. The only drawback to the excursion was the matter of carrying luggage, which could be checked only on certain lines. The advantage of the trolley trip over other modes of travel is that it is cleaner and cheaper, and that it carries one through the heart of towns, so that one can become better acquainted with the country.

In order to demonstrate the utility of electric stoves for household use, a dinner was recently given in Chicago, which was cooked on an electric stove adapted for a family of eight. However, eighteen persons were served, showing that the family range would be of ample capacity to meet all requirements of special dinners. The dinner consisted of consommé, roast beef, lima beans, potatoes, short cake, and coffee, and the cooking occupied two hours, with an electrical expenditure of 2,310 watt hours. The cost of the cooking, at the prevailing rate for current, was about 23 cents. In the cooking, the fireless cooker principle was employed to a certain extent, the food in each case being subjected to a maximum heat for a short time, after which the current was cut off, or at least greatly reduced, so that the heat absorbed would permeate the food, and cook it thoroughly.

To add to the horrors of a steamship collision at night, it often happens that the water reaches the dynamos, putting the lighting system out of commission, and making it impossible for the terrified passengers to find their way about. In order to prevent such an occurrence, one of the lake steamers has recently installed an emergency electric lighting system, connected with a storage battery which is placed on one of the upper decks. The batteries are charged during the day, when the regular lighting system is not in use. In this connection it is interesting to note that some of the theaters in Europe are using storage batteries to furnish the power for the lights at the exits, and that a Chicago theater has just installed a similar system. In this way a more reliable lighting system is assured, the necessity of which was very forcibly shown in the Iroquois disaster.

Our consul at Nice, France, has recently reported on the new system of sterilization adopted by that city for its drinking water. The water is sterilized by the use of ozone, which is produced in an ozone generator. The generator consists of copper plates between which are glass sheets, and the air between the plates is decomposed by a silent discharge at 17,000 volts pressure. The decomposed air is drawn by suction fans through a purifier, which eliminates the nitrogenous compounds, and thereafter the ozone is conducted to a chamber into which the water flows. The water passes through a layer of gravel on a wire netting, and falls into the chamber in the form of a heavy rain. The ozone absorbed by the water is thereafter extracted by having the water fall on stone steps. The water is then absolutely free of germs. There are two plants at Nice, one with an output of 40 gallons per second, and the other with an output of 80 gallons.

AERONAUTICS.

To Mrs. Bessie Raiche, of Mineola, L. I., belongs the honor of being the first aviatress in America. Mrs. Raiche made a series of short straight-line flights at Mineola on September 23rd.

The organization of the Aero Reserve is actively under way. The movement, which was begun on the Squantum aviation field in the earlier stages of the Harvard-Boston Aero Meet, has been so enthusiastically carried forward that the association now numbers 3,200 citizens.

Lieut. J. W. Seddon, R. N., has built what is probably the largest aeroplane in the world, a six-passenger tandem biplane which consists essentially of two biplanes, one behind the other, with the engines mounted on the framing connecting the two sets of surfaces. Two motors of 80 horse-power each are employed, which drive two huge propellers. The planes have an aggregate surface of 1,000 square feet.

The aviation committee which had charge of the Brigue to Milan trans-Alpine race has paid to the brother of George Chavez, who died at Domo d'Ossola on September 27th, of injuries received when he attempted to alight after he had crossed the Simplon, a check for $10,000. The original prize was $20,000. Chavez did not finish the flight to Milan.

James Radley, an English aviator, who holds a record (unofficial) for flying an aeroplane at the rate of 77.6 miles an hour, has arrived in this country to participate in the World-Post Dispatch $30,000 prize for a flight between New York and St. Louis, and also for the International Aviation Meet at Belmont Park this month, in which he will represent the Royal Aero Club of Great Britain.

After making five successful flights with pupils at the aviation school at Chartres on September 25th, Edmond Poillot, while landing on his sixth flight from a height of 150 feet, dropped like a stone to his death. No details are available at present, but it seems probable the machine may have been caught by a side gust. The pupil who was with Poillot was only slightly injured. The machine was a Savary two-propeller biplane, especially used for instruction.

An air line flight of 30 miles from Belmont Park and around the Statue of Liberty in New York harbor and return to the aviation field, is to be one of the most interesting and spectacular features of the international aviation tournament. The New York Herald states that it has learned from authoritative sources that a prize of at least $5,000 will be offered for the feat, which will be equivalent to the flight from the Squantum aviation field to Boston Light, accomplished by Mr. Grahame-White during the Harvard-Boston meet.

Mr. Clifford B. Harmon has offered cash prizes totaling $5,000 to the contestants in the New York Times-Chicago Evening Post aeroplane race from Chicago to New York, which starts on October 8th. This is in addition to his offer of $1,000 in cash or plate to the contestant who first flies 500 miles in 50 consecutive hours in the contest. To win the additional $4,000 the entrant, when arriving at New York from Chicago, must continue his flight to Belmont Park, covering the entire distance within 168 hours, or 7 days from the time of starting from Chicago.

The Municipal Council of Paris recently offered a prize of $1,000 for a flight with a passenger from Paris to Brussels, a distance of 175 miles as the crow flies. Loridan and Mathieu started on the morning of September 25th to make a flight, both using Farman biplanes. Mathieu landed half an hour after starting because of motor trouble. Just as he was about to start again, a big dog ran into his propeller and was cut to pieces which were flung by the whirling blades hundreds of feet. The propeller was smashed, and Mathieu had to postpone his flight. Loridan reached St. Quentin, 81 miles from Paris, where he intended to replenish his fuel supply. His motor stopped working and his aeroplane struck a tree, where it remained hanging. He could not continue his flight.

On September 29th Walter Brookins in a Wright biplane broke the world's record for cross-country flying. With only two stops he made the trip from Chicago to the State fair at Springfield, a distance of 186 miles, in 5 hours and 43 minutes, maintaining an average speed of 32.7 miles per hour. He won the prize of $10,000 offered by the Chicago Record-Herald for the feat. The trip included a thrilling race with a special train which had essayed to keep up with Brookins, but which was badly beaten. After flying 2 hours and 28 minutes, Brookins reached Gilman, 81 miles. Looking down, he became confused as to which track to follow. He decided to alight and await the arrival of the train. He mistook a cornfield for a green meadow and alighted in it, but without accident. From Gilman to Mount Pulaski, a distance of 88 miles, Brookins maintained a height of 1,000 feet. At Mount Pulaski he stopped because of a broken water pump and to take on oil. On the stretch from Gilman to Mount Pulaski, it is claimed that he beat Hamilton's record.

SCIENCE.

A patent has been taken out by A. Reuter for a quick-drying ink. An addition is made to the ink of a neutral, volatile substance such as alcohol or a similar material, in the proportion of one part to five of the ink.

Tuesday, Wednesday, and Thursday, September 27th to 29th, the American Fisheries Society held its fortieth annual meeting in New York. The first and last sessions were held at the Aquarium, and the second at the American Museum of Natural History.

In view of the varying data published concerning the solubility of gold in nitric acid, F. P. Dewey has carried out experiments which show that gold is dissolved to some extent when treated with the boiling, highly purified acid. The method employed to determine the amount of gold in the strongly acid solutions is described.

In the Chem. Zeit., Theodore Weyl describes a simple apparatus for determining melting points. A thermometer is slightly expanded just above the bulb. A glass ring loosely fitting the thermometer stem rests on the expansion; it carries glass hooks placed vertically in pairs which serve to hold the melting point tubes in position close to the bulb. This obviates the use of India rubber rings or platinum wire for attaching the tubes to the thermometer.

A patent has been granted to C. Petit in France for the treatment of seaweed. The seaweed (varech) is subjected to a bleaching process by steeping in a solution composed of bleaching powder, 6 kilograms; sodium hydroxide, 10 kilograms; and water, 90 liters, diluted to a density of 6 deg. B. After five hours' immersion the material is drained and soured with dilute sulphuric acid at a density of 1 deg. B. The product is suitable for packing purposes as a substitute for wood-wool, paper shavings, etc., and for other uses.

Last November's rains in Jamaica were in every way startling. The maximum rainfall occurred at mountain stations at the eastern part of the island, viz., 135 inches in 8 days at Silver Hill, with a maximum daily fall of 30.50 inches on the 6th, and 120.87 inches in 16 days at Farm Hill. These figures are comparable with the famous downpours at Cherrapunji, India, where 41 inches have been measured in a day and 114 inches in five days. The Jamaica rains caused disastrous floods and landslides, attended by loss of life and property.

In the Rev. Gen. Mat. Col., A. Chaplet describes a method of rendering fibers inflammable. This is effected by the fixation of insoluble magnesium-ammonium phosphate in the fiber. The materials are padded in a concentrated solution of a soluble phosphate, preferably the mono-calcium salt, and are then passed through an ammoniacal solution of magnesium chloride. Magnesium ammonium phosphate is thus precipitated on and in the fiber, and after rinsing in very dilute ammonia and drying, the material is practically non-inflammable. This property is only slightly affected by rubbing or washing.

William Harmon Niles, professor at the Massachusetts Institute of Technology, who had long been prominent among educators in that State, died in Boston on September 13th, at the age of seventy-two years. He was born in Northampton on May 18th, 1838. Prof. Niles received his first impulse to follow a scientific career from Louis Agassiz, of whom he was a pupil at Cambridge. For several years after completing his preliminary education Prof. Niles was employed by the State Board of Education of Massachusetts as an instructor and lecturer in natural science at the State teachers' Institutes. In 1871 he was appointed professor of physical geology and geography at the Massachusetts Institute of Technology.

It is popularly supposed that women possess a more highly developed color sense than men. In a recent number of the University of Colorado Studies, Mr. V. A. C. Henmon shows that the experimental evidence in support of the theory is unsatisfactory and inconclusive. Experiments undertaken by Nichols showed that men were decidedly more sensitive in the recognition of red, yellow, and green, while women were more sensitive to blue. Yet, on the other hand, Miss Helen B. Thompson found that men were better with blue and yellow on a white background, and that women were better in red and in green. Miss Nelson finds that women in general are less keen in the recognition of colors than men. Tests on the discrimination of differences in color, the threshold of difference, show greater agreement. Women are in general superior to men in the discriminative sensibility, and as Mr. Henmon shows, particularly in their discriminative sensibility to reds and greens; for he too believes that men show a decidedly greater sensibility in discriminating reds. He finds that in school children between the ages of eleven and fifteen, there is no significant difference in the perception of difference in red, and that the variability and range are slightly greater in girls.

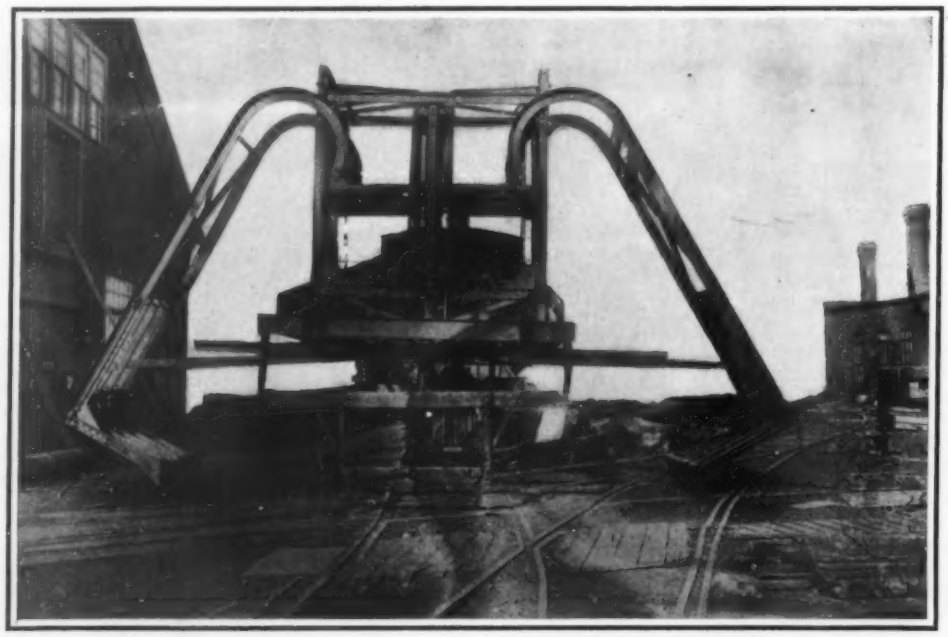
A TRACK LIFTING AND BALLASTING MACHINE

A MACHINE THAT DOES THE WORK OF JACKS AND SHOVELERS

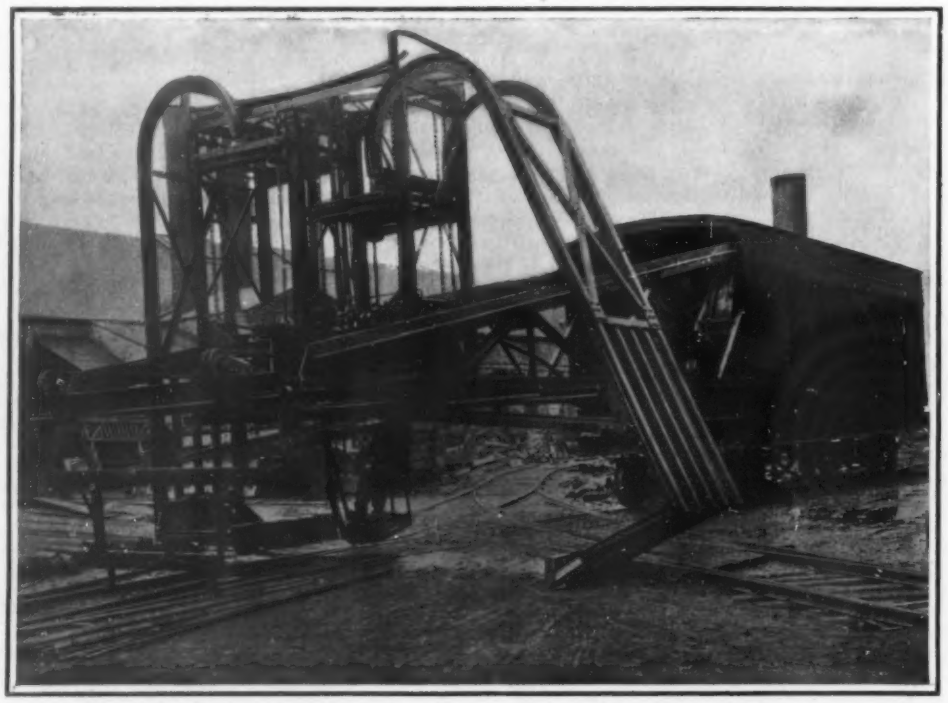
Some ingenious and very effective machines have been designed for the maintenance of railroad track, and we illustrate in this issue a machine which is designed to run either on a railroad track or a highway and to draw up earth from the side of the roadbed to the top of said bed. It is especially designed to raise the grade of a railway roadbed, upon which a track has already been laid, and when used for such a purpose, it is equipped with means for lifting the track and holding it in suspension while the new earth is being moved into position beneath it. This machine is designed to be operated by five men, whose positions are two on the main car, one on the chair suspended from the carriage on the boom, and two on the ground at opposite sides of the boom.

The machine does the work of lifting jacks and a gang of shovelers and tampers. It is designed to build embankments without the use of trestles. The general plan of its operations is that it runs on a temporary track laid on the fill, picks up a section of track, draws earth in from the sides of the roadbed beneath the ties and tamps it there. It then runs forward to raise another section, and so proceeds to raise the track by stages, going back and forth over the same ground until the proper elevation has been reached. In a test made by the first machine ever built, it put the ballast underneath the ties and tamped the same at a cost of less than three cents per yard. In other words, the machine would do the work of about one hundred men with their jacks, shovels, and tamping bars. This machine will also put the berme on the grade by raising the shovels to the level of the ties and moving them out horizontally.

The machine consists of a self-propelled car, carrying the boiler and machinery, from one end of which extends a 36-foot trussed boom, carrying the track-lifting devices and a carriage on which are the shovel arms and the operator's seat. By the operator's seat are the levers controlling the various movements of the machine. Both the track-lifting devices and the shovel-arm carriage move back and forth along the boom. The boom is fastened to a pivoted turntable in the body of the car. On this turntable is mounted the boiler, transporting engines, pivoted masts, and a part of the operating machinery. The boom is connected to these masts, which are held by adjustable backstays, permitting the boom to be raised or lowered. The revolving table affords free lateral motion to the boom.



End view, showing the hinged shovel arms extended ready for an inward stroke.



This remarkable machine consists of a self-propelled car from which projects a 36-foot boom on which are supported powerful track-lifting, shoveling, and tamping devices.

A POWERFUL TRACK LIFTING AND BALLASTING MACHINE.

The track-lifting device consists of two traveling grappling arms, which are moved to any desired position on the boom, engaged with the rails at the joints and mid-points, and then raised until there is sufficient clear space beneath the ties for the shovels to operate.

A battery of shovel arms is on each side of the traveling car. The battery on one side may be operated independently of that on the other side, or single shovels in a battery may be operated independently of the others. The shovel arms have both a lateral and vertical motion, and a joint at the point where the shovels are connected with the arms makes it possible to move the shovels at any desired angle with the arms. This is to provide a horizontal instead of a radial motion of the shovels while under the ties. The shovels reach under the center of the track, and by the radial and vertical motions of the arms are arranged to go out 7½ feet beyond the ends of the ties and 4 feet below the ties.

In operation, the car is run out by its own power to a point where the boom overhangs a depressed portion of the track. The gripping devices are then attached to the track, and operated to raise a section of it. If the track is out of line, the turntable may be operated to swing the boom and suspended track to one side or the other. The shovels may be then pushed out and the sashes lowered until the shovels engage earth at the side of the track. The shovels are then drawn in and sashes raised until the new earth is brought to position beneath the ties. The empty shovels are then operated back and forth to tamp the earth. The carriage is now moved forward to ballast another battery length of the track. When the carriage has reached the end of the boom, the section of track may be dropped and the car run forward till the boom overhangs another or more depressed section of track, where the operation is repeated. If desired, the machine may be operated two or more times over the same depressed portions until all is brought up to grade.

After the shovels have placed and tamped all the material, they may be swung clear to the sides of the roadbed, dirt trains can be run in on the track, and the filling and ballasting material dumped in windrows along the sides of the track, where the shovels will reach and place it.

In view of its many apparent capabilities, economy of service, strength and durability of construction, saving, as we contend, the labor of many men and reducing the perils of loss by labor strikes and scarcity of men, the machine will no doubt awaken great interest among contractors and railroad companies.

Rubber in Brazil.

The British Legation in Brazil have furnished the following information relating to the rubber industry in that country: In 1908, 38,206,461 kilogrammes of rubber, valued at $58,921,185, were exported, while in 1909 the exports amounted to 39,026,738 kilogrammes valued at $94,630,305, the price per kilogramme having risen from $4 in 1908 to $7.25 in 1909. These figures show that the statements which have been made that the increase of price was due to a reduction in the amount of Brazilian rubber collected were unfounded; on the contrary, there was a small increase of some 820,000 kilogrammes in the production.

It is only reasonable to suppose that, as the rubber-bearing territory secured to Brazil by her late treaty with Peru is worked, and as the communications by river and the Madeira-Mamoré railway, which is in course of construction, are opened up, the production will largely increase. It must be remembered that Brazil has an enormous advantage over the plantations in other parts of the world; in Brazil the only expense in connection with the production of rubber is that of gathering it, while in the case of cultivated rubber there are all the expenses connected with the plantation to be considered. On the other hand, owing to the care taken, the plantation rubber is put upon the market in far better condition than is that of Brazil.

Although the natural supply of rubber in Brazil seems to be almost inexhaustible, it appears that the authorities of the State of Pará are alive to the dangers of the competition of plantation rubber and of the wasteful collection of "seringa," the growth of which is confined to the Amazon. This they show by encouraging the laying out and cultivation of plantations and granting various privileges to the cultivators.

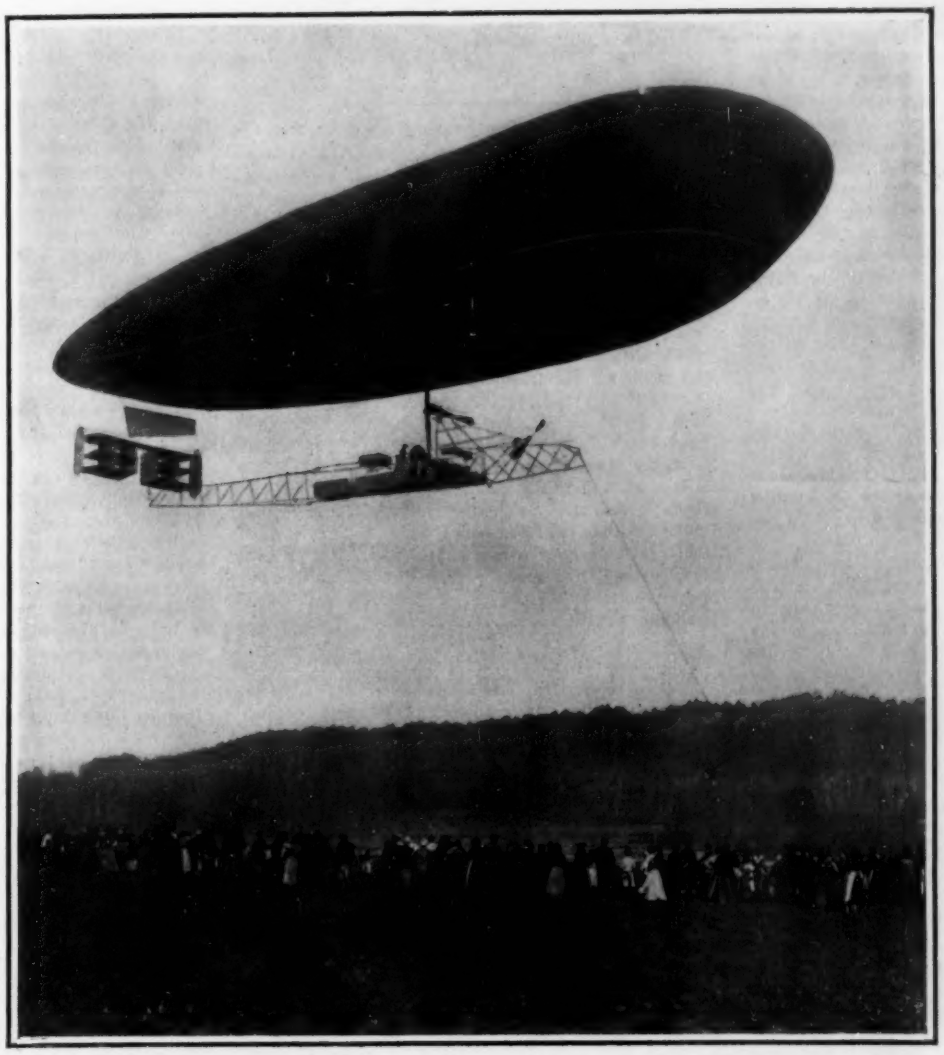
Boston capitalists are endeavoring to secure an appropriation from Congress to dredge the Island End River. If this can be obtained they will build a $1,000,000 blast furnace. This is not as visionary a scheme as it looks, for the coke from the city gas works would furnish the fuel and the reduction in the tariff on iron ore makes it possible to import Cuban ore much cheaper than formerly. A blast furnace there would have the advantage of having a home market in New England for the product.—Railway and Engineering Review.

"CLEMENT-BAYARD II."

BY CARL DIENSTBACH.

The rôle that France once played in the conquest of the air has in recent years undergone a peculiar change. When eight years ago an engineer of rare skill and knowledge, M. Julliot, made the proper use of the aerial experience of the intrepid Brazilian, Santos-Dumont, and when the true "father of aerostatic flight," Col. Renard, at about the same time finally revealed the secrets of his life work (the art of balancing dirigible balloons in rapid flight), the "Lebaudy" airship sprang into existence and placed France far in the lead in the conquest of the air with the lighter-than-air-machine. Capt. Sacerac de Farge was not far from the truth when he wrote at that time that France alone knew the secret of truly navigating the the air.

But, the very excellence of early French accomplishment has led to the curious result, that we see France to-day vastly outdistanced by Germany, and perhaps more than equaled by Italy. The type of the "Lebaudy," "Patrie," and "République" airships was so harmoniously developed, so perfect for a size of about 2,500 cubic meters displacement, that it did not call for any special improvement. Thus French apathy is to be explained.



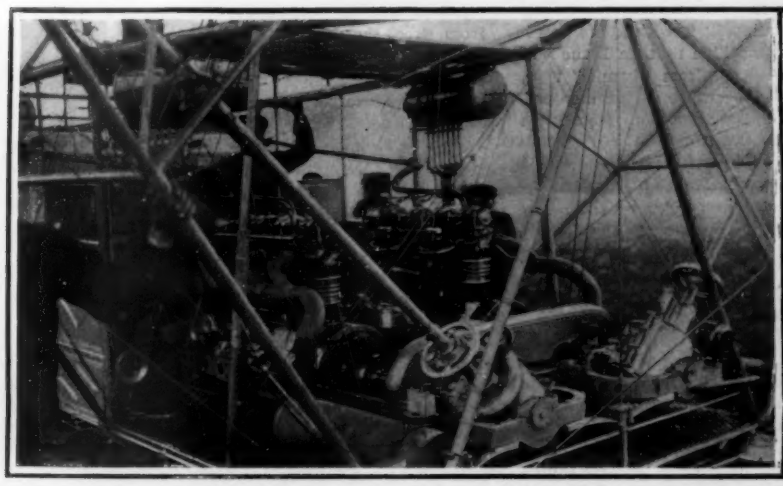
The "Clement-Bayard II.," which took part in the French military maneuvers.

Fortunately the wonderful work of Col. Renard, the "Lilienthal of aerostatic art," was to survive him in more than the one feature of stabilizers, with which every ship of the air is now equipped. The "Lebaudy's" French competitors soon realized that there was still another way of perfecting the Santos-Dumont "toy"; that of making it more similar to Renard's original creation, the electrically propelled dirigible "La France" of 1884.

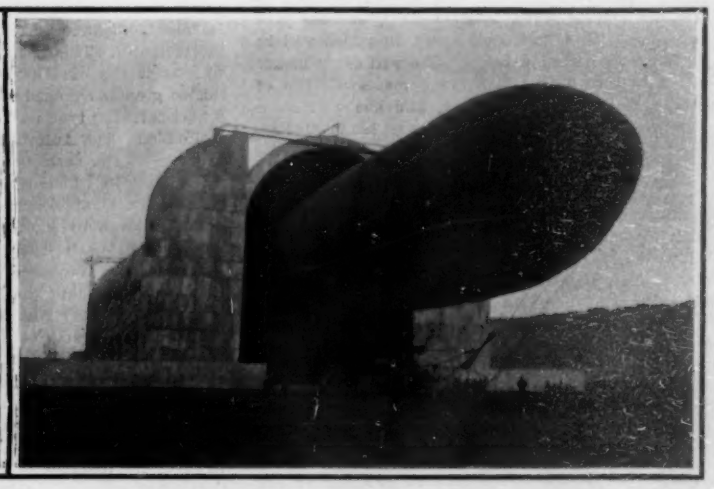
In the course of time, French aeronautic engineers began to realize that over twenty years ago Col. Renard had already perfected the dirigible in every essential feature but the motive power. It was perhaps fortunate that his imitators were not nearly so successful in their first attempts as the creators of the "Lebaudy" type.

The "Ville de Paris," their first ship, was decidedly inferior to the "Patrie." But there was a spur to improvement, and still more important, an inducement to resort to that powerful remedy of deficient results in airshipping—increase of size. The improved and larger "Ville de Paris," the "Clement-Bayard I.," was a step in advance. The

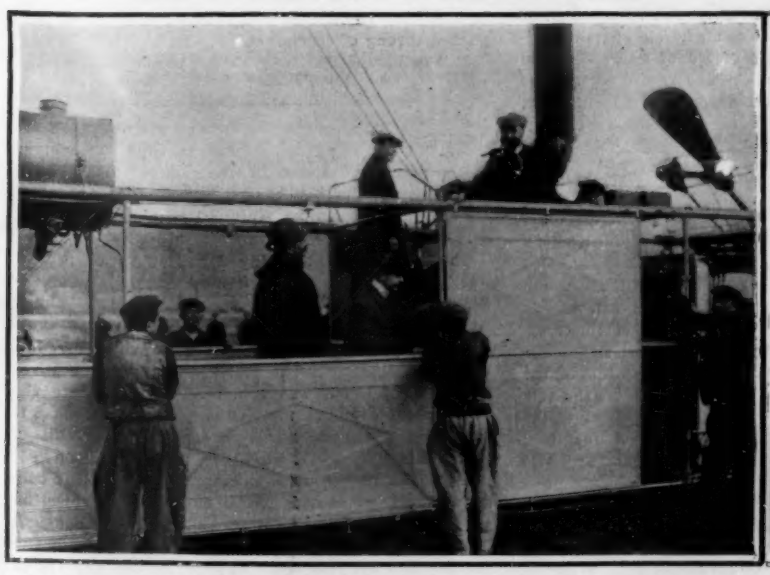
(Continued on page 283.)



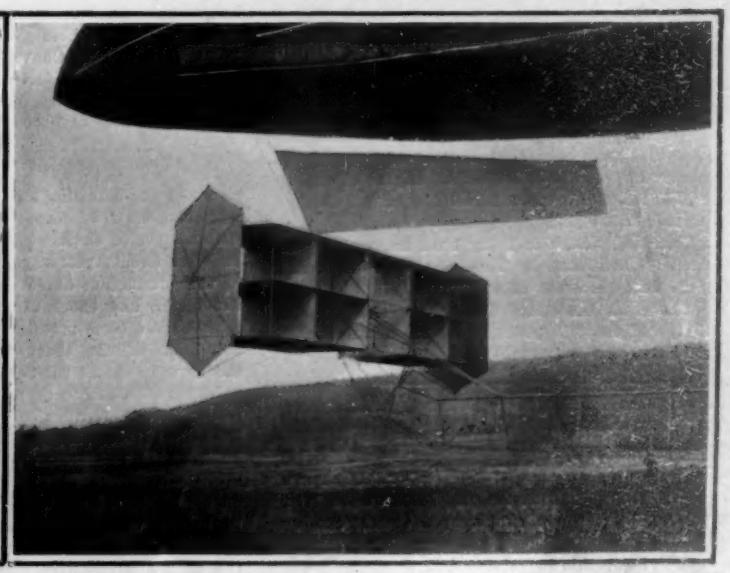
One of the 125 H.-P. engines of the "Clement-Bayard II."



The "Clement-Bayard" emerging from the shed.



The car spaces are formed by forking and doubling the frame's "backbone."



The Stabilizing box tail of the "Clement Bayard."

THE FRENCH MILITARY DIRIGIBLE AIRSHIP "CLEMENT-BAYARD II."

THE LARGEST OCEAN-GOING SCHOONER YACHT.

Those of us who have not forgotten that famous trans-Atlantic race for the Emperor's cup, which took place in 1905, will remember that among the contesting yachts was the "Thistle," an able, two-masted schooner, which evidently gained some of its sea-going qualities at the cost of speed—as was proved by the results of that hard-fought contest. The race was won by the large three-masted schooner "Atlantic," a low-lying racing craft, with fine lines and a huge sail spread, which, during one whole day of the contest, reeled off the miles at an average speed of about 14 knots. The "Atlantic" measures 139 feet on the waterline and 184 on deck, and she is probably the fastest sailing yacht of any kind afloat at the present time.

The owner of the "Thistle," Robert E. Tod, of the New York and Atlantic yacht clubs, one of our amateur yachtsmen who always acts as his own skipper and navigator, has recently placed an order for a three-masted, cruising schooner, which will be the largest yacht of its class afloat. If all goes well, she will be completed and in commission in time for the ocean race, which will probably be sailed across the Atlantic some time during the summer of next year. The vessel, which is being built by the Staten Island Shipbuilding Company, will, for the present at least, depend entirely upon her sail power for propulsion. She is being so constructed, however, that at any time in the future it will be possible to install an engine (steam, oil, or producer gas, as the case may be) without interfering seriously with the present plan of the interior accommodations.

As will be seen from the subjoined table, giving the dimensions of the largest schooner yachts at present afloat, the "Karina," as the new schooner will be named, will be the largest schooner yacht in existence. She will measure 198 feet 6½ inches on deck, 150 feet on the load waterline, 33 feet 8½ inches extreme beam, 23 feet 9 inches depth of hold, and her draught will be 17 feet. The next largest vessel, which is almost identical in dimensions, is the auxiliary schooner "Visitor II.," 197 feet 6 inches over all, 150 feet on the water line, and 32 feet 6 inches beam.

THE LARGEST SCHOONER YACHTS.

	Length on deck.	Waterline length.	Beam.
"Karina"	198 ft. 6½ in.	150 ft.	33 ft. 8½ in.
"Visitor II."	197 ft. 6 in.	150 ft.	32 ft. 6 in.
"Atlantic"	184 ft.	139 ft.	29 ft.

The "Karina" is being built of steel, and she will be provided with a half deck house, in which will be a companionway leading below. She will carry in her keel 150 tons of lead. Her lower masts will be of steel, and the topmasts of wood, and she will show the spoon bow which has become so popular in modern yachts. Her freeboard will be liberal. Around the foremast will be a small bridge which will form a pleasant lookout station, particularly in calm and moderate weather. Although the "Karina" will carry no driving engine for the present, she will be provided with a donkey boiler to furnish steam for the electric lighting plant and for operating the pumps, windlass, capstan, etc.

In a yacht of this size it is possible to provide very liberal accommodations. There will be two large staterooms with bath in the after part of the vessel, for the owner, and four staterooms farther forward for guests. The main saloon will be over 30 feet wide, and of sufficient length to provide a large and comfortable room.

Although the particulars regarding sail spread are not given out, it is announced that it will be "liberal," and probably the sail plan has been drawn with a view to getting the maximum speed out of the hull in future ocean races. Probably her sail spread will greatly exceed that of any existing yacht carrying a fore-and-aft rig. The question of the type of motive power is being left open, the owner believing that we are on the eve of important developments in internal-combustion engines, and that a delay of a few years will render it possible to install an engine of considerable power that will make a relatively small demand upon space and weight.

The "Karina," which is being built from plans and specifications furnished by Theodore B. Wells of this city, will carry a crew of twenty-six all told. The contract calls for the completion of the vessel by May 1st, 1911, and she will probably be in commission by Memorial Day of that year.

Another Barrel Trip Through the Niagara Rapids.

Another unnecessary trip through the Niagara rapids was made by a man named Leech, "Bobby Leech," according to the newspapers, on September 24th. He started out from the old "Maid of the Mist" landing in the afternoon, shot over the giant combers between the narrow banks of the gorge, then through the rough rapids, his barrel drifting fairly well over the rough waters. For nearly an hour he tossed around the maëlstrom currents. Finally he was caught by helping hands at Driftwood Point and brought to shore uninjured.

The latest previous barrel trip was made by Maud Willard on September 7th, 1901. She lost her life.

Prizes at the International Aviation Meeting.

The list of prizes thus far announced by the Aviation Committee for the Belmont Park contest amounts to $55,650, and has been arranged for competition as follows:

Gordon Bennett Trophy, winner also gets....	$5,000
Gordon Bennett elimination, three prizes total.	1,500
Totalization for duration.....	6,000
Totalization for distance.....	3,000
Grand speed.....	4,500
Grand altitude	3,000
Fastest flight, ten kilometers.....	3,000
Passenger carrying.....	1,600
Cross country	1,700
Cross-country passenger-carrying	2,000
Kilometer straightaway	2,550
Daily totalization of duration, eight days, $850 each	6,800
Hourly altitude, thirteen hours, $400 each....	5,200
Hourly distance, seven hours, $400 each.....	2,800
Hourly speed, five hours, $400 each.....	2,000
Michelin prize	4,000
Mechanics' prize	1,000
Total	$55,650

Advices received at the headquarters of the International Aviation Tournament, to be held October 22nd to October 30th, at Belmont Park, give the information that the contesting French aviators have defined their respective work at the tournament. Count de Lesseps, Emile Aubrun, Leon Morane, and M. Simon all intend to go after the altitude record and the various speed records, outside of the International Speed Trophy. Aubrun and Simon will also try to capture the record for daily totalization of time spent in the air. De Lesseps, by his ability to fly across the English Channel, and Aubrun, the only other flyer besides LeBlanc who finished in the 488-mile cross-country race in France, are especially qualified to remain a long time in the air. It has been learned that Alfred le Blanc, Hubert Latham, and M. Thomas, the members of the team selected by the Aero Club of France to lift the International Trophy, are making extraordinary preparations to accomplish this aim. Louis Blériot is finishing the very latest model of his famous monoplane and equipping it with a 100 horse-power motor. This is the machine that Le Blanc will fly. It is the old Blériot XI. "Cross Channel" type, not so greatly changed in appearance as the new passenger-carrying type used by Moissant to fly from Paris to London. The Antoinette Company is also mounting a motor of the same power on their highly improved monoplane, in which Hubert Latham will compete for the trophy. The Antoinette to be flown by Thomas will be driven by a motor of 80 horse-power. Aside from the similarly equipped Blériot with which Leon Morane made the speed record at Rheims, no flying machine of such power has been driven in any competition. Morane, who holds the world's record for speed over distances of five and ten kilometers, made at Rheims with a Blériot of 100 horse-power, will use the same machine at Belmont Park. In France Morane is regarded as the most dashing aviator in the world. He is famous for his skill in taking shorter curves than any other European, a feat that has enabled him to cover the distance in the quickest time. He thinks nothing of soaring to a height of more than 3,000 feet two or three times in an afternoon, doing in a half hour what others take an hour or two to accomplish. Morane will undoubtedly make an heroic effort at Belmont Park to beat Chavez's record of 8,409 feet. He must rise only 1,591 feet above the record to win the special prize of $5,000 offered for the machine that gains an altitude of 10,000 feet.

The marked increase of the sensitiveness of an instrument for detecting alternating currents of electricity when the free period of the instrument coincides with the period of the current was pointed out by Prof. M. Wien twenty years ago. The property has since led to the production of several forms of vibration galvanometer, and the theory of the instrument has to some extent been investigated. A more complete examination of the theory, and a comparison of the theory with the actual behavior of three forms of the galvanometer, are to be found in a paper on the subject by Mr. F. Wenner in the February number of the Bulletin of the Bureau of Standards. A few new hints as to the design of the instruments are also given. In order to avoid giving the instrument a double period the moving system must be symmetrical. In bridge work the resistance of the galvanometer should be very much less than that of the bridge, and the back electromotive force developed in the instrument should be half that impresed on the galvanometer circuit.

The Vanderbilt Cup Race for 1910.

In several respects the Vanderbilt Cup race for 1910 surpasses any preceding race for this famous trophy. The course was better, the average speed higher, and the list of entrants was larger than ever before. Moreover, the steadiness of the running proved that, except possibly in the matter of tires, an all-round improvement has been made in the strength and running qualities of the machines.

As usual, the tire was the most frequent source of delay; and, wonderful as the high-class tire has become in its ability to stand such severe duty as is being put upon it in these high-speed, long-distance races, it must be considered to-day the weakest part of the automobile. Incidentally, it may be mentioned that the tire is the most expensive element in the automobile, both in maintenance and replacement.

The course, which included the concreted Motor Parkway, was laid out on Long Island. The complete circuit measured 12.64 miles, and the contestants for the Vanderbilt cup were required to cover this distance twenty-two times, the total distance of the race being 278.08 miles. Nearly one-half of the course was laid over the excellent concrete surface of the Motor Parkway, the balance being over the ordinary macadam roads of Long Island. The good going on the Parkway, however, was somewhat neutralized by the dry and loose condition of the macadam roads. These, because of the long drought, and the fact that the large number of entries caused the roads to be severely tried out in the daily practice spins during the week preceding the race, left the surface in rather poor condition. Therefore the high average speed of 65.4 miles per hour made by the winner, Harry F. Grant, in an Alco, must be regarded as very creditable. The best previous speed was made by Robertson in a Locomobile in 1908.

The list of entrants included thirty-two racers, namely: Three Marquette-Buicks; three Benz cars; two Nationals; two Oldsmobiles; two Simplex machines; two Stoddard-Daytons; two Pope-Hartfords; and one each of the following cars: Lozier, Mercedes, Amplex, Columbia, Corbin, Jackson, Marmon, American, Apperson, Royal, and Knox.

The race started at an unusually fast pace, Chevrolet in a Marquette-Buick making several rounds at an average speed of 75 miles an hour. Indeed, in the earlier stages of the race the four leaders were covering the circuit of 12.64 miles in eleven minutes—a speed of 69 miles an hour. But history was again repeated, and the leaders were soon in trouble, chiefly from tires, the race ultimately being won by the car which maintained an even speed throughout the whole 278 miles.

The Alco covered the distance in 4 hours 15 minutes, 58.39 seconds. The second car, a Marmon, driven by Joseph Dawson, took 4 hours 16 minutes 23.57 seconds to complete the race, and the third car, a National, was timed in 4 hours 17 minutes 29.72 seconds.

During the progress of the Vanderbilt Cup race two other events for cars of less power were started. The Wheatley Hills sweepstakes was won by J. F. Gainow in a Fal car over a 189.6-mile course, and the Massapequa sweepstakes, over a distance of 126.4 miles, was won by William Endicott in a Cole car.

As usual, the great race took its toll of human life—this time a distressingly heavy one. Harold Stone and his mechanician were killed by their car losing a rear tire and the machine plunging over a bridge to the railroad tracks below. The mechanician of the Marquette-Buick car, driven by Chevrolet, was killed in a collision with a touring car along the route. Several onlookers were either killed or seriously hurt by being either run over in crossing the roadway, or by racing cars leaving the course and running into the densely-packed throng of spectators.

It is estimated that fully 250,000 people witnessed the races.

A $15,000 Prize for Aeroplanes.

Mr. Edwin Gould has offered, through the columns of the Scientific American, the sum of $15,000, which is to be awarded for the construction of a heavier-than-air flying machine, equipped with more than one motor and propeller.

The conditions governing Mr. Gould's offer were published in the Scientific American, issue of September 17th.

In Switzerland so many accidents have occurred to boys who climb poles and touch the live line wires that a commission was appointed to investigate the matter and devise a method of preventing access to the wires by unauthorized persons. As a result of their deliberations, a guard is now placed on the poles which is known as a "porcupine ring." It consists of a band provided with downwardly projecting spurs. The band encircles the pole, and is made fast by means of a bolt which can be operated only by the use of a suitable key. This precaution appears to have solved the difficulty, for up to the present there have been no accidents along lines thus protected.

Correspondence.

THE PERPETUAL MOTION PROBLEM.

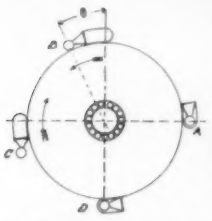
To the Editor of the SCIENTIFIC AMERICAN:

I inclose a sketch of a simplified form of Mr. Horton's "perpetual motion" machine, which makes the latter easier to understand. The only difference is that here we have just one wheel instead of two wheels and a belt. The method of *not* working is exactly the same.

The reason this machine will not work is because the work done by the cylinder of air in rising to the top is equal to the work required to force the air from the top cylinder down to the bottom one.

The nearest analogy to illustrate this is that of a child forcing a hollow rubber ball to the bottom of a bathtub full of water and allowing it to spring up to the surface.

In the figure it can be seen that the ball *D* does not tend to rotate the wheel in any direction, while balls *A* and *C* are practically balanced as far as their weight and leverage are concerned. But *C's* cylinder is exerting an upward force, and ball *B* exerts a downward force.



Now the work required to raise *B* through the angle *O* to the top center and at the same time to fill *D's* cylinder with air is equal to the work which any one cylinder would do in rotating through 90 deg., or through a space equal to the distance between two successive cylinders. Therefore, as we have two equal and opposite forces acting against one another, there will be consequently no motion produced.

Northside, Cincinnati, O. W. R. COOPER.

To the Editor of the SCIENTIFIC AMERICAN:

With reference to Mr. Horton's perpetual motion problem in the SCIENTIFIC AMERICAN of September 17th, 1910, I think the fallacy of his machine is explained as follows: When the air vessels round the bottom pulley on the upward curve and the weight distends the flexible cover, this weight is thrown out beyond the radius of the other weights. This results in an increased resistance at this point, which offsets the buoyancy of the enlarged vessels, and, therefore, the machine is inoperative. PAUL DICKSON.

Atlanta, Ga.

To the Editor of the SCIENTIFIC AMERICAN:

Perpetual motion machine, page 214, issue September 17th, 1910. You ask why the machine would not operate. I cannot see how this differs in principle by being submerged in water from any of hundreds of similar machines with rolling, sliding, or falling weights on a belt or wheel. As in all such, a part of the work done by each weight on the falling or driving side is expended in the shifting, hence is not employed in driving; in the present instance, the weight in pulling the flexible cover in at the top against the excess of air pressure from below, and in pulling it out again at the bottom against the excess pressure of water from above, performs no work in driving except to shift the air from one cylinder to another; and therefore the *useful* travel of each weight on the driving side is less than the distance raised. As for the boxes themselves, they are of no earthly consequence to the machine except to confuse the issue.

In more precise terms, each weight in falling in at the top, and the diametrically opposite weight falling out at the bottom, act as a piston, the one by pressure, the other by suction, to drive an excess of air to the rising side. The work producing this excess of buoyancy, that is to say, the work done in displacing the water from the bottom cylinder, exactly equals the work of the weights falling through the distance to produce it plus the work of the water moving into the air space at the top. This work is done against the weights on the rising side and returned by the weights on the falling side in the shape of excess buoyancy, leaving the total work performed upon one side equal to that performed by the other.

Milwaukee, Wis. GEORGE W. COLLES.

To the Editor of the SCIENTIFIC AMERICAN:

Yesterday we tried to discover the fourth dimension, and to-morrow we will square the circle; but to-day we are going to evade the law of the conservation of energy, and, incidentally, Standard Oil, by building an automobile that will run without gasoline. The full details of the motive power for this marvelous discovery were published in the SCIENTIFIC AMERICAN for September 17th by Mr. Horton. But for some reason Mr. Horton's model did not work; so he has asked the public for suggestions how to make it run, or for proofs that it won't run.

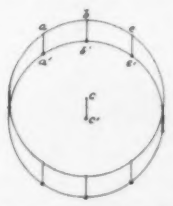
It is clearly evident and perfectly true that the buoyant force of the water is greater on the left-hand side of the machine than on the right-hand side, and hence, due to this upward force of the water, the machine will tend to revolve in the direction of the hands of a watch. But what is not so clear, though just as true, is that the mass centers of the bodies on the two sides are not in line, those on the left side being lower than those on the right. If the sketch in the original article be referred to, it will be easily seen that the cylinders are not movable and hence balance each other, but that the lead balls on one side are near the center of the cylinder, while on the other side they are at some distance away from the center. It is therefore easily seen that the centers of gravity of the bodies on the left-hand side are lower than those on the right, and hence there will be a moment tending to turn the machine in the opposite direction to the hands of a watch. If there was no friction, the machine would come to rest at the position where the downward moment of the weights is just balanced by the upward force of the water. In all so-called perpetual motion machines, it is possible to show that the moments around any axis are equal to zero.

In closing, I wish to congratulate Mr. Horton on presenting one of the few really clever schemes for perpetual motion. While we will all agree at the start that no perpetual motion machine will work, in this case it takes some long and hard thinking to discover just where this "nigger in the woodpile" is.

Washington, D. C. W. S. DURAND.

To the Editor of the SCIENTIFIC AMERICAN:

May I propose the following solution of Mr. Richard P. Horton's perpetual motion problem? Bringing the curved parts together, we have the following diagram:



Since, on turning, the balls fall from their true positions *a*, *b*, *c*, etc., to the lower positions a^1, b^1, c^1, etc., the center of gravity of the system falls from *c* to c^1, while the system must revolve on the center *c*. Hence, in order to operate, the weight of the lowered balls must be lifted through the distance cc^1. The compression in the cylinders is brought about by the falling of the balls, and the loss of buoyancy is exactly balanced by the force necessary to raise the system through cc^1. A. C. PALMER.

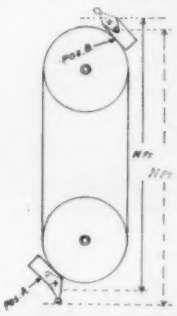
Pomfret, Conn.

To the Editor of the SCIENTIFIC AMERICAN:

Inclosed find my discussion of the so-called perpetual motion machine described in September 17th issue of the SCIENTIFIC AMERICAN.

Let us suppose that when the vessels reach their highest point, they are at the surface of the water.

Take one of the vessels as at position *b* in the figure.



It is buoyed up by a force equal to the weight of water that it displaces with its diaphragm in its collapsed condition.

Then take the same vessel when it has moved to position *a*. It is buoyed up by a force equal to the weight of water it displaces with its diaphragm in its distended condition. Therefore, the difference between the buoyancy of the vessel in passing from *a* to *b*, and the buoyancy in passing from *b* to *a* is equal to the weight of the water displaced by the diaphragm in passing from its collapsed condition to its distended condition, which volume we will call *x* pounds. Then in making one complete revolution it would develop (if no energy were lost elsewhere) *nx* foot-pounds of work going clockwise.

Now when the weight pulls the diaphragm from the collapsed position to the distended position, it must do the work required to displace *x* pounds of water at *a*, or in other words it must do the work equivalent to lifting *x* pounds of water from *a* to the surface, or *nx* foot-pounds. This energy must be subtracted from the power generated by the weight in passing from its highest point to its lowest point, which is *wn* foot-pounds (*w* = weight of weight). Then *wn* foot-pounds — *nx* foot-pounds = force of weight which tends to move the vessel clockwise. But it requires *wn* foot-pounds to lift the weight from its lowest point to its highest point. Then we have *wn* foot-pounds — *nx* foot-pounds — *wn* foot-pounds, which leaves — *nx* foot-pounds acting clockwise, or *nx* foot-pounds acting counter clockwise, due to the action of the weight, which exactly balances the force acting clockwise due to the difference in buoyancy. The resultant is zero. If the resultant of the forces acting upon one vessel in making one complete revolution is zero, it is obvious that no matter how many vessels are attached, the result would be the same.

If the machine is immersed in the water a distance, it would require more work to displace the volume of water *x* at the lower level. But this would be exactly offset by the impact of the water when the diaphragm passes from its distended condition to its collapsed condition, as at *a* in the figure.

The difference in air pressure in the vessels also balances. ARTHUR ROBISON.

Joy, Ill.

To the Editor of the SCIENTIFIC AMERICAN:

The perpetual motion proposition of Mr. Horton in your issue of September 17th is unusually interesting, but would fail for the reason that the work performed by the inflated vessels in rising would exactly equal the work required of the collapsing vessels to send the air down against the water pressure.

Onset, Mass. E. D. ELDREDGE.

The Current Supplement.

The gigantic work of tunneling the Bernese Oberland is described in an illustrated article which opens the current SUPPLEMENT, No. 1814.—Mr. Andrew Lewis writes on safety appliances on submarines, a most important subject in view of the number of fatalities which have occurred.—Mr. E. D. Sewall concludes his excellent consideration of the status of process inventions.—The foreign press has of late devoted much more than ordinary space to the comparatively recent applications of that singularly curious, very attractive, and as yet imperfectly understood spinning top called the gyroscope. One of these applications is the automatic balancing of an aeroplane in flight. Mr. Paul F. Mottelay contributes an excellent description of the investigations which Mr. Paul Regnard has made to adapt the gyroscope to the aeroplane.—Mr. Edward H. Guilford continues his paper on a wireless telegraph station and how a 1,000-mile wireless telegraph station can be built.—There still remains much uncertainty as to the exact functions of the various parts of the internal ear. The arrangement of the semicircular canals in three planes practically at right angles to one another very naturally suggests an apparatus adapted to the functions of equilibration and of orientation to the lines of force of gravitation. The whole matter is briefly but excellently considered by Mr. S. S. Maxwell is an article entitled "Experiments on the Functions of the Internal Ear."—In a series of twenty-five pictures, the metamorphosis of the seventeen-year locust is presented.—The Berlin correspondent of the SCIENTIFIC AMERICAN contributes an illustrated article on "Fixation of Atmospheric Nitrogen by the Pauling Process."—Dr. H. W. Wiley, who has done more than any other man in this country to give us pure food, writes on the ethics of food, a subject with which he is assuredly familiar.—Dr. Frederic S. Lee presents an analysis of the phenomena of in which experimental investigations made thus far fatigue.—Prof. Milliken of the University of Chicago presents the first instalment of a remarkable paper on "The Isolation of the Ion." In it he gives a new study of gaseous ionization, by means of which it is possible to catch on a minute object one single atmospheric ion or any number of ions up to 150.

A Mosquito-Proof Steamer.

The first ocean-going mosquito-proof vessel built for the African trade, the "Jonathan Holt," will shortly commence its regular service in the Liverpool-West African trade as a vessel of John Holt & Co., Liverpool. Fittings are provided against the intrusion of mosquitoes in the quarters of both passengers and crew. All doorways, side-port openings, windows, skylights, ventilators, and passages have been provided with mosquito-proof, close-mesh gauze coverings, which, while allowing the necessary ventilation, prevent the admission of the disease-bearing mosquito. Great care has been given to the convenient placing of these fittings to make them readily adjustable. The vessel is 262 feet long, has 38 feet beam, and is 18 feet 3 inches in depth. The plan of arrangement adopted was recommended by Prof. Major Ronald Ross, C. B., a recognized malarial expert, whose malarial recommendations are very generally known throughout the Tropics. He is publishing a book on prevention of malaria, which will contain a full description and plans for fitting vessels like the one mentioned.—Consul Horace Lee Washington, Liverpool.

The Death of Chavez.

Chavez died on the afternoon of September 27th as a result of the injuries sustained in his trans-Alpine flight. He was born of Peruvian parentage in Paris in 1887. He first attracted attention on August 3rd last, when at the Blackpool, England, meet he reached an altitude of 5,405 feet. On September 8th at Issy, France, he established a new altitude record, officially determined at 8,409 feet. He was the only man who flew in the trans-Alpine competition, for a prize of $20,000 offered by the Italian Aviation Society of Milan. He succeeded in overcoming the erratic winds of the Alps, and was about to land at Domo d'Ossola when his machine apparently collapsed. Besides both legs, his left thigh was broken. Internal injuries were also sustained. For a time it was thought he might recover.

MAGIC FOR AMATEURS—XIII

MISCELLANEOUS TRICKS

BY W. H. RADCLIFFE

NO. 30. EGG MAGIC.

Time honored in the annals of magical history is the egg bag, an ingenious device which has fooled thousands who were never fooled before and remains to fool countless thousands more.

It is made as shown in Fig. 45 of flannel or alpaca, and when finished is about six inches wide and eight inches deep. One of the sides, *c*, is double for about two-thirds of its depth, the material on that side being folded down inward from the mouth of the bag as shown by the dotted lines *c* in the end view *B*, and stitched in with the sides of the bag, but left open at the bottom *s*. There is thus formed a pocket, mouth downward, inside of the bag.

As usually shown, a hard boiled egg is used in connection with the bag; but to modernize the trick so that it will be even more perplexing and entertaining, let the egg you use be prepared as follows: Get a fresh egg, and with a needle pierce a small hole through each end; then by blowing into the hole at the larger end drive out the contents through the opposite hole. After the inside of the egg shell has become thoroughly dry, fill it a quarter full with fine sand, and close the

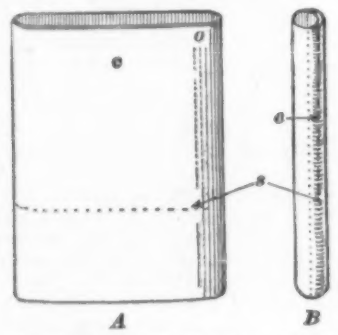


Fig. 45.—THE MYSTIFYING EGG BAG. DOTTED LINES IN SIDE AND END VIEWS REPRESENT THE SECRET COMPARTMENT.

holes by pasting over them paper or court plaster of the same color as the shell.

Place this egg in a bottom corner of the inner pocket of the bag and lay the bag, pocket side downward, flat upon a table.

When ready to perform the trick pick up the bag with the hands at the corners of its mouth and with the pocket side toward you, grasping the egg through the cloth so as to prevent it from falling out of the pocket. Facing the audience with the bag held in this manner, raise the bottom with the hand that is not grasping the egg and turn the bag upside down, at the same time releasing the egg, which will remain in the inner pocket of its own accord. Call attention to the bag being empty, and then to convince any "doubting Thomases" in the audience, turn the bag inside out, still keeping the pocket side toward you.

Hold the bag for a moment between your teeth while pulling up your cuffs to show there is nothing up your sleeve, and then turn the bag outside in to its normal position, taking care to keep the pocket side toward you as before. The egg will then drop down into the bottom of the bag, which should then be tilted so that the egg will roll to the right-hand corner. Grasping the egg through the bag at this point with the right hand, strike the remaining portion of the bag against

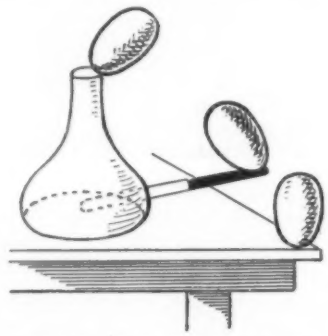


Fig. 46.—EGGS PRODUCED BY THE EGG BAG HAVE NO RESPECT FOR THE LAWS OF GRAVITY.

the left hand to prove it is empty and then with the left hand twist up that part of the bag not held in the right hand, finally untwisting it by squeezing it down between the fore-finger and thumb of the left hand.

If this is well done there can be no doubt in the minds of the spectators that the bag is empty, so that when the performer reaches in and brings out an egg, at the same time imitating the clucking of a hen, great surprise and amusement are created.

Tell the audience that an egg produced in this way always differs from an ordinary one in that it has no respect for the "humpty dumpty" laws of gravity—that no matter in what position it is placed by its maker it will honor him by remaining in that position. To illustrate this point make the egg balance itself on either end and on the edge of a table, a knife or other object as indicated in Fig. 46. All that is necessary to do this, is to tap the shell lightly with the fore-finger when placing it in the desired position so that the sand inside settles at the bottom of the shell.

NO. 31. THE ENCHANTED CABINET.

One of the most ingenious devices to keep the guesser guessing, is the enchanted cabinet shown in Fig. 47. Any small article placed in it changes into a different

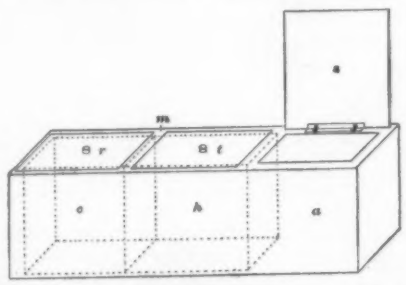


Fig. 47.—FOR USE IN MYSTERIOUS SURPRISES, STARTLING TRANSFORMATIONS, AND BEWILDERING DISAPPEARANCES THIS CABINET IS VERY EFFICIENT.

article or completely vanishes, according to the wishes of the performer.

The outfit comprises a wooden box *a*, about ten inches long, four inches wide and three inches high, smoothly finished inside; also a two-compartment thin wooden drawer shown dotted at *ch*, of such size and finish that it slides easily back and forth within the box *a* and occupies exactly two-thirds of its inner length. The outer width and height of the drawer should be about one-eighth inch less than the inner dimensions of the box.

The two compartments in the drawer formed by its central partition should be exactly equal in size, and the three openings in the top covering *m* of the box should be so spaced that when the drawer is at the left as indicated in the sectional view, Fig. 48, the compartment formed at the right end of the box appears to be a permanent one; also, when the drawer is at the right end, the extreme left compartment appears permanent. Each top opening of the box should be provided with a hinged lid.

To enable the performer to secretly slide the drawer back and forth within the box without raising the lids, a small peg or tack *n*, Fig. 48, is fastened into the back side of the drawer through a narrow slot *e*, cut lengthwise in the rear of the box.

Before exhibiting the cabinet the compartment *h*,

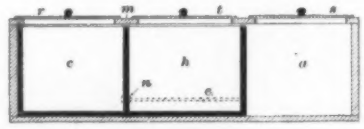


Fig. 48.—SECTIONAL VIEW OF THE CABINET SHOWN IN Fig. 47.

Fig. 47, of the drawer, is filled with candy, peanuts or whatever it is desired to have the article later placed in the cabinet changed into. After the spectators have been given a general view of the outside of the cabinet the lids are raised in succession and the three compartments shown empty. This is accomplished as follows: With the drawer located as in Fig. 47 the lid *s* is raised; the drawer is then shifted to the opposite end of the box by moving the peg at the back and the lid *r* is raised; then the lid *t* is raised. As the cabinet may be held in the hands during this exhibition, the peg at the back can easily be manipulated without detection.

An apple, orange or other article is then placed by one of the spectators in the drawer compartment *c*, which is now at the middle of the cabinet, and the lid is closed. The compartment at the left end is then shown empty, and by secretly moving the drawer to the left, the compartment at the right end is shown empty. Then the cabinet is placed on a table, and the fruit commanded to change into candy or nuts. After touching the lid of the middle compartment with the wand, it is raised and the astonishing transformation is shown to have occurred. To strengthen the illusion, the three compartments may be shown empty after the candy or nuts have been removed, by operating the drawer as before.

A New Vegetable.

M. Aug. Chevalier gives an interesting account of a vegetable of the bean variety which grows in Africa in the Dahomey region. The grains, the size of a very small pea, are formed underground and appear in pods. There is no evidence that this plant is known in Europe. Previously we knew two plants of this kind in Africa, one of these being an archide which resembles South American plants and the other is the Voandzon, this latter being the only species of the genus *Voandzeia*. The third plant which we mention here is cultivated for its edible grains. M. Eugene Poisson, who is familiar with the Dahomey region, pointed out its existence in the interior of the country. Such grains are sold in the markets of Abomey under the name of *doï*. The author observed the doï plants both in flower and in bearing young fruits, and examined the dry grains which the natives obtained for him. The doï plant is a new species of *Voandzeia*.

The pods which are found at the root of the plant carry only one or two grains. When there are two grains these are separated by a complete partition and the pod is narrower here. From this description it may be supposed that the pod is somewhat like the American peanut, in form, at least, although it is of smaller size. As we find for the bean, the doï has several varieties, differing by the color of the grains, and these are oftenest white, but can also be black, red or variegated. The area occupied by the plant is very limited, being only a restricted region in the central part of Dahomey. It can be eaten in the same way as the bean, and has a very agreeable taste. Owing to the small size of the grain, the production is very limited, and it is reserved for the chiefs or other favored persons. For this reason the Dahomey usage forbids the eating of the grains by women.

An Acoustic Microscope.

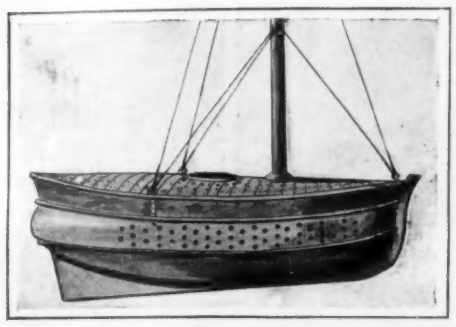
As is well known, the Academy of Sciences of Vienna possesses a very generous collection of phonograms. The commission in charge of these archives is now working zealously to increase to the greatest degree attainable the series of idioms and variations of dialects, and for this purpose is preparing delegations to all countries. The first of these will be for Sweden and Nubia. The proposed records, however, will not be made merely for purposes of culture and of the history of language; the commission has greatly enlarged the field of work of the phonograph, and has made of the instrument an indispensable inventory of acoustic science. In this respect the phonograph serves as an "acoustic microscope," so to speak, for small sections of the records on the plate are magnified a thousandfold, and so form an invaluable comparative material for the theory of the formation of sound and speech and noises.

One of the latest results of investigation in accordance with this method may be mentioned as an instructive instance of the importance of this kind of microscopical study: who that has the finest aural perception is able to decide whether the "A" of human speech concurs acoustically with the "A" sound, with its astonishing similarity, which is uttered by the frog in its croaking tone? Here the observer in the absence of the aid of the phonograph is restricted to his sensibility and is exposed to subjective errors, and for this reason such investigation must lack an exact basis. But such tonal emission magnified a thousandfold shows promptly that the "A" sound of the frog is intermitted at brief intervals, a fact which the human ear cannot grasp under ordinary circumstances, and that unlike the "A" of human speech it is a tone of interruption. From this point of view may be recognized also the keen importance this method has for the examination of pathological disturbances of speech, for instance, and for the differentiation of dialects even to their smallest details.

THE EARLY DAYS OF SUBMARINE WARFARE

AN ANCIENT FANCY AND ITS MODERN REALIZATION

Most people, if they were asked their opinion, would tell you that submarine warfare was about the very

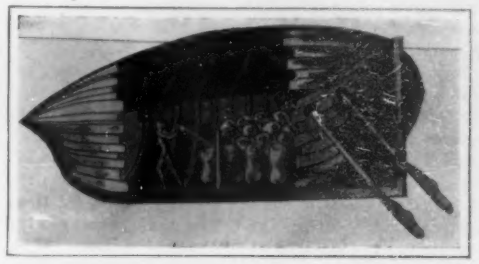


Possible appearance of Wm. Bourne's boat, 1578.

latest of naval inventions. As a matter of fact, it is one of the oldest. Underwater attack, of a more or less crude nature, is an extremely ancient method of assailing an enemy afloat. Several classical writers refer to the use of divers in warfare, and Aristotle plainly states that, in his day, they used a tube for getting air when under water, "like the trunk of an elephant." Pliny also refers to some kind of a diving apparatus. Callurícus is said to have invented something in the nature of a submarine gun, while Lucullus sent a diver through an enemy's fleet in a distended goat's skin, which caused him to be taken for a fish. Then there was the famous diver, Scyllis of Scyone, who, without any apparatus at all, dived down and cut the cables of a Persian fleet at anchor, with the result that many ships were wrecked, thanks to the bad weather that prevailed. According to Thucydides, the Athenians made use of divers to cut away the piles with which the Syracusans had defended the entrance of their harbor in B. C. 414-5.

According to medieval writers, Alexander the Great explored the bottom of the sea in a glass barrel, and a quaint drawing of the monarch engaged in this unkingly occupation may be seen in a thirteenth century manuscript in the Burgundy Library at Brussels. But then Alexander the Great was used as a peg on which to hang most fables of that period.

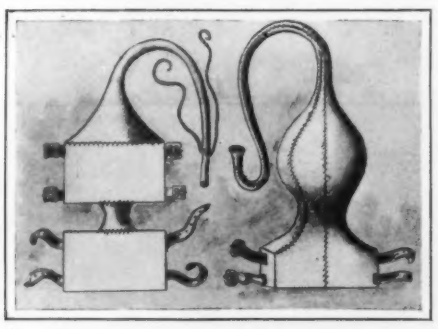
An Arabian historian in the twelfth century mentions the use of diving apparatus at the siege of Ptolemis. Again, in 1190, an actual submarine is



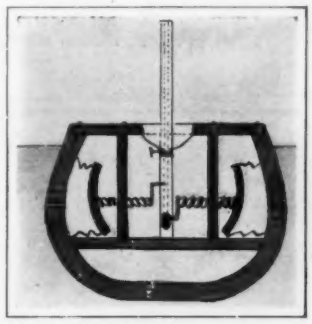
Symon's submarine, 1729. From a cut in the Gentleman's Magazine of 1747.

mentioned in a German poem entitled, "Salaman and Moroll." There used to be a picture of it in the manuscript, but it is not now to be found. The fam-

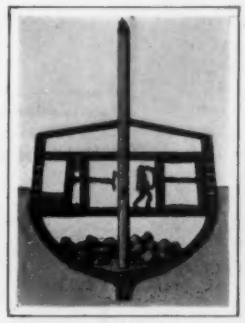
(*Continued on page 285.*)



Medieval diving helmets (Kettelhattes). From Vegeticis, 1511.



According to Lt. Delpench in "*La Navigation Sous-Marine.*"

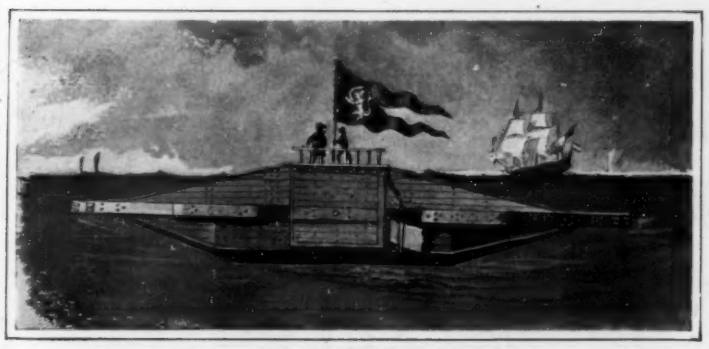


Probable construction of the boat according to the author.

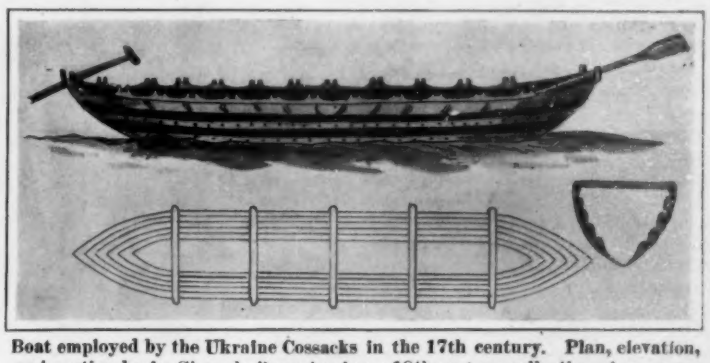
Cross-section of Bourne's submarine, 1578.

Papin's reconstruction of Van Driebel's submarine.

Drawn from a diagram in Delpench's "*Navigation Sous-Marine.*"



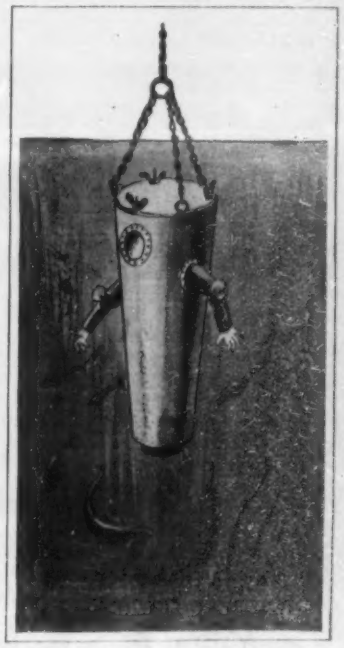
De Lais submarine. The Rotterdam ship, 1654.



Boat employed by the Ukraine Cossacks in the 17th century. Plan, elevation, and section by Le Sieur de Beauplan in an 18th century collection of voyages.

Diver with tube and air-bladder. Adapted from Vegeticis, 1511.

Sir William Monson's scheme of underwater attack.



Lethbridge's diving machine, 1715.

THE EARLY DAYS OF SUBMARINE WARFARE.

AUTOMOBILE PICNICS O

BY DR. ALFRE

The latest development in the use of automobiles for military purposes is the substitution of an automobile kitchen train for the field kitchen of the German Emperor. Apart from its incomparably higher speed, this automobile train contains far more comprehensive appointments than a field kitchen drawn by horses is able to carry.

The kitchen train, constructed by the Daimler Motoren Gesellschaft of Untertürkheim, consists of the kitchen automobile proper, with a fitted-in stove, and a motor-bus for use in conveying the crew. Each of these cars comprises a Mercedes chassis with a 45 horse-power motor, the fore-wheels being fitted with 915/105 millimeter (36.02/4.13 inch) pneumatic tires and removable fellies, and the rear wheels with removable double fellies of the same dimensions.

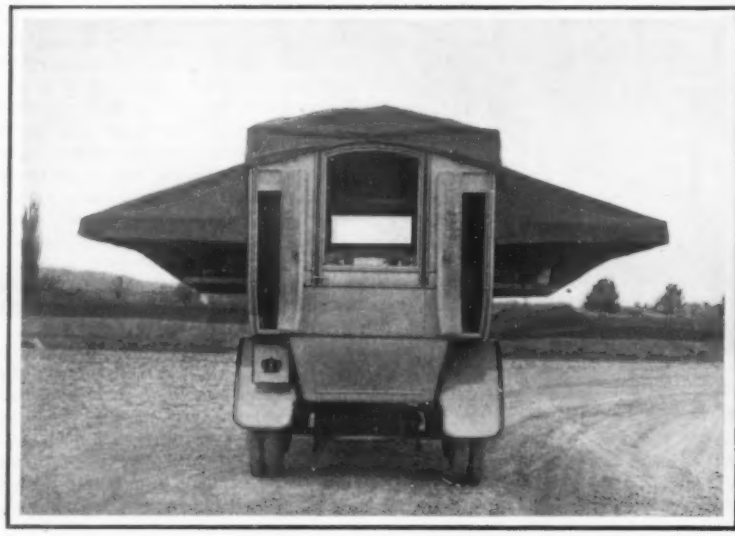
While the motor-bus is fitted with several glass windows, the kitchen car proper outwardly resembles a closed bus or parcel mail van. In the front half of the side walls of this latter car, hinged traps are provided, which can be folded up outward into a horizontal position so as to serve as auxiliary tables. The interior of the car is lighted by large sliding windows in the front and rear walls in addition to which small ventilating windows are furnished in the side walls. On account of the double curvature of the roof, the height of the car body is relatively small at the sides, while the central part of the roof is of sufficient height for a man, standing upright, to operate the stove and kitchen when the car is under way.

The door leading to the interior of the car is arranged in the rear wall, and comprises an upholstered hinged seat. The double upholstered driver's seat in front of the car body is protected by a roof and an adjustable glass pane located in front of it. In addition, a splash leather surrounds the double seat.

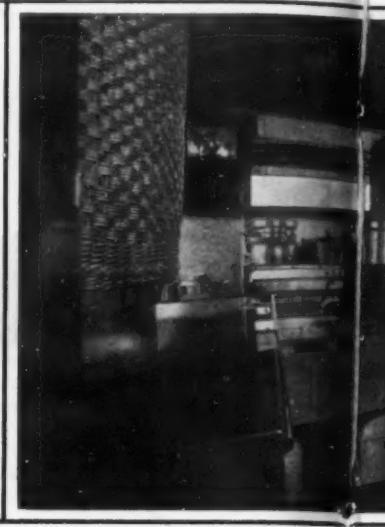
The roof has a water-tight sail-cloth coating, below which, part of the kitchen equipment is stowed away. On both sides of the car there can be lowered from the fixed roof an adjustable tent roof, which will be found of special service when the kitchen is to be operated in bad weather.

The various objects forming the equipment of the kitchen, as well as the spare parts and tools required for the upkeep of the engine, are arranged so as to take up as little space as possible. The tools, spare parts, etc., are located below the driver's seat and in a storeroom fitted behind the chassis. The proper arrangement of the kitchen equipment was by no means an easy task.

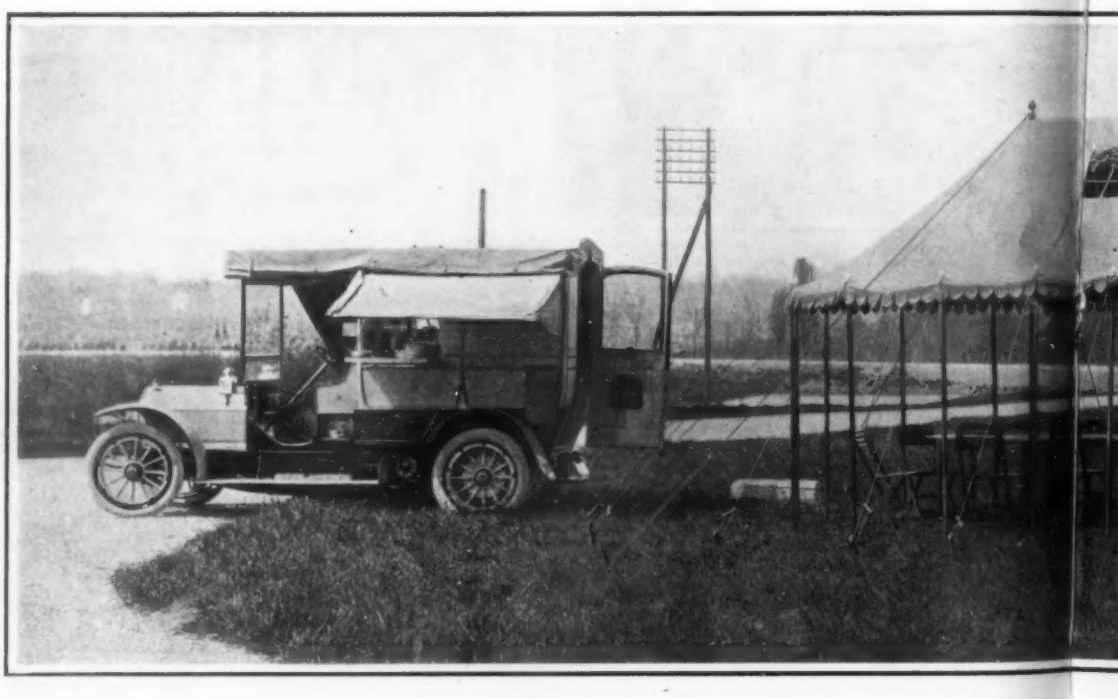
In the front wall of the car, below the large window, is located the kitchen stove heated with alcohol. This apparatus comprises five flames and a hot-water tank. Below the stove are installed two large ice tanks for cooling meat, butter and wine, and above the window there are two boxes for preserving provisions, to the right of which there are arranged hermetically locked metal tanks for receiving sundry provisions (vegetables, spices, and other articles of food), while to the right and left there is a cabinet for holding silver forks, knives and plates for the use of twelve persons. A number of baskets for bread and table linen serve to supplement the interior appointments of the kitchen. In the upper ceiling are fitted two metal tanks containing about 60 liters (63.4 quarts) of alcohol, and outside of



Kitchen car seen from the rear.



Inside view of the



General view of the kitchen train. The automobile kitchen train of the Kaiser in workin; orde

HOW GERMAN ROYALTY GOES PI

The Reconstruction of the New York Fire Alarm Telegraph System.

BY HERBERT T. WADE.

Among the many improvements now in progress in the New York Fire Department none is of greater importance than the rehabilitation and reconstruction of the fire alarm telegraph system, work on which has been recently undertaken. The new scheme adopted is one of striking novelty in fire alarm work and contains many interesting features which never before have found application in this field, though well known in other branches of electrical engineering. The importance of an efficient and well-protected alarm system to a fire department is naturally beyond the slightest question, and the shortcomings of that of New York have been known for many years. They have been the subject of many reports by underwriters and other committees and have been referred to in these columns.

The present system at best is antiquated. If it has succeeded in the past, it has been through experience and skill at headquarters. Of some 900 fire-alarm boxes in the Borough of Manhattan, only about 80 are of modern type, the great majority being interfering, non-successive boxes on a limited number of circuits. When several signals are received simultaneously, which sometimes occurs, especially when several boxes are "pulled" for the same fire, the services of an expert operator are required to disentangle and interpret the alarm. Sometimes the signals come in faintly because of faulty circuits.

The number of boxes on the separate circuits is too large, and the interlacing of the various circuits increases the mileage unnecessarily. Furthermore, the distribution system is poorly arranged, and the main cables carried on the structures of the elevated railways or in ducts, often in proximity to high-tension power cables, are for the most part insufficiently protected. Throughout the system the insulation is defective. Faults exist that would not be tolerated by any telegraph or telephone company for its city service. The central station itself at Fire Headquarters, which houses the offices of the department and two fire companies, has a large fire risk, and any serious fire in this non-fireproof building not only would damage instruments and conductors, but would put the entire fire-alarm system of Manhattan out of operation, and compel the use of telephones for the transmission of fire signals until it could be repaired or replaced. In fact, it has only been within a few weeks that the old-fashioned gravity cells, long obsolete for central station use, have been replaced by a modern storage battery plant with charging generators and switchboard. Quite as archaic was the connecting board, where the cables entering the building terminate, and from which the various conductors are led to the appropriate circuits and relays. The replacement of this board and the lightning arresters and fuses with modern equipment has been also begun.

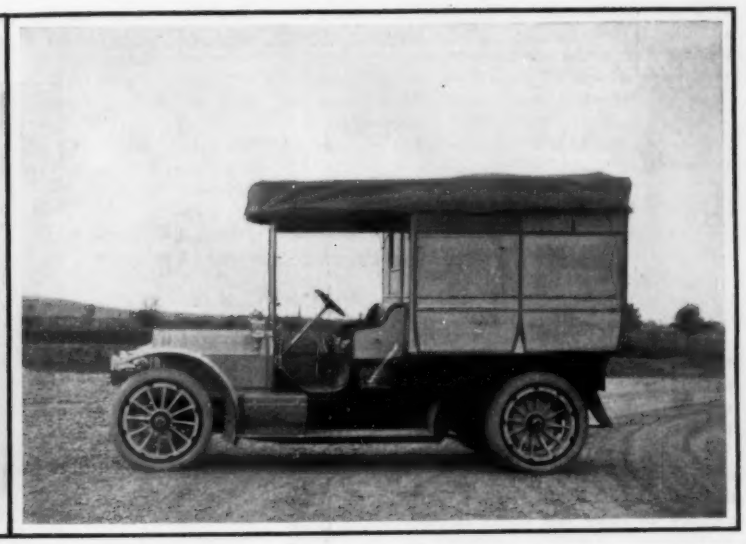
In the first detailed report dealing with the reconstruction of the fire-alarm telegraph system (more improvement otherwise was quite impossible), prepared by Kempster B. Miller, the well-known telephone engineer, it was estimated that the cost of a new central station equipment, distribution system, boxes, etc., would amount to about $1,750,000 and in addition there would be required a small absolutely fireproof central station building used for no other purpose and located in Central Park or some other place far away from any possible danger by conflagration or flood. The plan proposed in this report involved the use of a non-interfering successive signal system of alarm boxes, considered to-day the best practice for fire-alarm telegraph systems. The present Fire Commissioner a few months ago appointed an electrical engineer to supervise the technical work of the Fire Alarm Telegraph Bureau, and the changes and additions to the system made possible by recent appropriations. When the proposed scheme was examined in some detail, it was suggested that economy and efficiency of operation could be secured by the installation of a system modeled along the lines of that maintained by a city telephone company.

The necessity of adopting some permanent and comprehensive plan was apparent, and it is the intention

OF THE GERMAN EMPEROR

EL GRADENWITZ

ew of the kitchen car.



Side view of kitchen car closed.

working order with tent installed. Kitchen car to the left. Accompanying motor-bus to the right.

the car there are installed two ice tanks. Below the left driver's seat there is finally located a hinged washstand, to which water is supplied from a tank located on the front roof, the dirty water being discharged as the trap is folded up.

All the various kitchen utensils are fixed to the walls in the interior of the car in such a way as to remain in position even in the case of a relatively high speed of traveling.

The same car, however, serves to transport, in addition to the kitchen utensils and crockery, a complete large tent accommodating twelve persons, of the same type as has been used with advantage in the colonies. This oval-shaped tent, which will stand very bad weather, is 6 meters (19.7 feet) in length and 4 meters (13.12 feet) in width, the height in the center being 3.6 meters (11.8 feet), and at the sides 2.1 meters (6.9 feet). It is readily installed by two to three men within a few minutes on any ground, and only weighs about 100 kilogrammes (220½ pounds). In the middle of this tent is placed on oval table 4½ meters (14¾ feet) in length, 1 meter (3.28 feet) in width, and 65 kilogrammes (143.3 pounds) in weight, which can be folded up in four parts; it is surrounded by twelve folding wooden chairs which are of remarkable solidity and of small weight. When the car is under way, some of the chairs are located in the interior of the car, and the remainder, as well as the various parts of the table, in its double walls. The tent cloth for the roof, which comprises two sliding windows, and the peripheral walls (into which two glass windows can be fitted) are conveniently located on the roof of the car.

The motor-bus accompanying the kitchen car is provided with the standard Daimler bus carosserie. In its interior it accommodates eight to ten persons, whereas the driver's seat (provided with a protective glass pane, and all other accessories) affords room for two persons.

The roof of the bus is mainly intended for accommodating luggage, and to this effect is surrounded by a railing alongside of which there is installed a folding tent with bars, so that the immediate neighborhood of the car is well protected.

The benches installed in the interior of the bus are removable and can be used for sitting in the open; below these benches are provided storage boxes for kitchen supplies and additional luggage. Furthermore, the interior of the car is so arranged that the various seats can be used to put up a complete field bed in a longitudinal direction, so that the Emperor may even spend the night on the maneuver grounds or in the field. The huge glass panes of the bus are in this case covered by blinds.

Both cars are painted cream and dark blue with gold stripes, which are the colors of the imperial automobiles. They have been thoroughly tested on various grounds with full load, the average speed of the kitchen car being 30 kilometers (18.64 miles) per hour. The double fellies enable the automobile train to cover short distances even with damaged pneumatic tires, so that the cars will always be sure to reach their destination in due time.

This new automobile kitchen train will doubtless attract much attention at the next maneuvers.

PICNICKING IN AUTOMOBILES

of Commissioner Waldo so to improve and extend the fire-alarm system that the new additions and replacements built as money is appropriated by the city will be integral parts of an improved and complete system.

The electrical engineer of the Fire Department, Mr. John C. Rennard, a former member of the engineering staff of the New York Telephone Company, has now prepared the preliminary plans for such a new system, which involves many radical departures from present practice, and in its essential features will be absolutely unique. It is proposed to run a pair of wires from every fire-alarm box in the city to a central station, just as is done in a telephone system from each instrument or switchboard. In the Borough of Manhattan there will be about 2,000 of these boxes, or one on every other street corner, so that no box shall be more than a block distant from any possible fire. The double conductors from these boxes will be carried in a paper-insulated cable composed of not more than 100 pairs of wires. With direct communication from each box to the central station, there is obviously no need of any complicated signaling system or apparatus to prevent interference, as a simple push button and annunciator would suffice on such a direct line. But to make the action doubly sure, at each box is to be installed the simplest form of clockwork train and brake wheel, on whose notched circumference a make and break signal corresponding with the number of the box would be made and transmitted. Such a box, being of the simplest construction, would in no way conflict with the elaborate mechanism required on the best non-interfering successive signal systems.

In each box there would be a telephone connection, so that a cord and instrument could be connected; and after the platform operator at headquarters was signaled, communication could be established. In this connection it might be said that it is the intention of the Commissioner eventually to install a complete intercommunicating telephone throughout the entire department, using its own wires and switchboards, so as to be independent of the telephone company, which now under lease maintains a special service for the Fire Department. This, of course, will be possible, as the new fire-alarm telegraph will make use of standard telephone cable.

Another important feature of the proposed system is that it will give to the Fire Department greater control over the auxiliary or special alarm systems maintained by private companies and connected with the present fire-alarm boxes, often it is said to the detriment of the latter, and occasioning needless and false alarms. With the new boxes any private alarm installed in a building under regulations and conditions approved by the Fire Department would give an alarm direct to fire headquarters in such a manner as its supervising engineers would arrange.

At the central station the terminals of the direct wires from the boxes would be connected, each with a telephone spring jack, and a certain number of boxes, probably ten, would be connected with a sounder. In case two or more alarms were coming in simultaneously, the operator, by means of a conducting cord, could connect the separate lines to pen or punch registers to obtain a clear and permanent record without the slightest confusion.

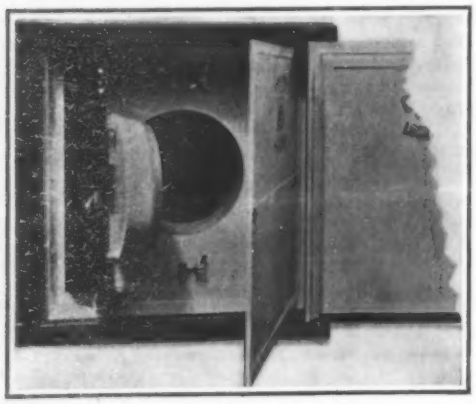
So far as the transmission system by which the signals are sent out to the various fire houses, fire boats, and pumping stations (aside from reconstructing and rearranging the circuits, which will be through the same cables as the box circuits, there is not the same need of radical improvements), it is only necessary to provide better conductors and more perfect insulation. This transmission of alarms to the engine houses is effected by fitting a small brass notched wheel appropriate to the signal to be sent out to a transmitting machine, and this causes the small gong in each fire house to sound, while a second signal on an independent circuit goes out a few seconds later, when the wheel is adjusted on another spindle. This second signal sounded on the large gong often rings after the apparatus due on the alarm has left the house, if a quick hitch has been made. It is proposed to install a part of the work

(*Continued on page 286.*)

CURIOSITIES OF SCIENCE AND INVENTION

A SAFE FOR RADIUM.

The high value of radium renders it necessary to exercise all possible caution in storing accumulations of this precious element. The first safe for radium has recently been constructed to the order of the British Radium Corporation. As the safe is entirely novel in design, a brief description of its structural characteristics will not be without interest to readers of the Scientific American. That it should be burglar-proof



A SAFE FOR STORING RADIUM. CAPACITY $5,000,000,000 WORTH.

was, of course, an essential condition; nor was this difficult of attainment. A requirement less easy to fulfill was that the safe should be proof against the escape of the radium itself. Steel would not serve the purpose, as radium emanations pass through the thickest armor plate as readily as sunlight passes through clear glass. Extensive investigations showed that practically the only metal which the radium emanations fail to penetrate is lead; but a leaden safe would not safeguard its contents from the attacks of skillful burglars. The plan ultimately adopted was to construct a safe within a safe; in other words, a leaden shell or coffer protected by a steel casing.

The inner safe is composed of pure lead three inches in thickness. The door is circular in form, and fits with such absolute precision that no ray can escape through the joints. Moreover, by means of a special contrivance, any slight looseness which may result from wear and tear in opening and closing the door can be readily adjusted.

To prevent the loss of accumulated radium emanations when the inner door of the safe is opened, two valves have been inserted. Before the door is opened, two tubes with mercury will be passed through, and these will collect and store the emanations.

The safe weighs a ton and a half; and although it is only about 3 feet in height, its contents—if ever it were filled with radium—would exceed $5,000,000,000 in value at the current market price.

THE CATTABU, A CROSS BETWEEN TEXAN AND INDIAN CATTLE.

Six years ago Secretary Wilson, of the Department of Agriculture, found in Texas a grade of so-called Brahma cattle. Inquiring into their origin he found that they were the offspring of a zebu bull or sacred cattle of India, which had been purchased from a circus and liberated in Southern Texas. Secretary Wilson found that the Brahma cattle were remarkably free from disease and the thriftiest cattle in all the region; that the dreaded Texas tick did not attack them, and that they took quite naturally to the marshes of the Gulf coast and thrived where the American and European breeds degenerated and died.

The Secretary of Agriculture encouraged A. P. Borden, who had great cattle interests in Wharton County, Texas, to import from India a sufficient number of the sacred cattle to make a thorough experiment as to their adaptability and value. In 1906 a consignment of twenty-five head, mostly bulls, were landed and taken to the Pierce ranch in Wharton County. There they have since thrived and multiplied.

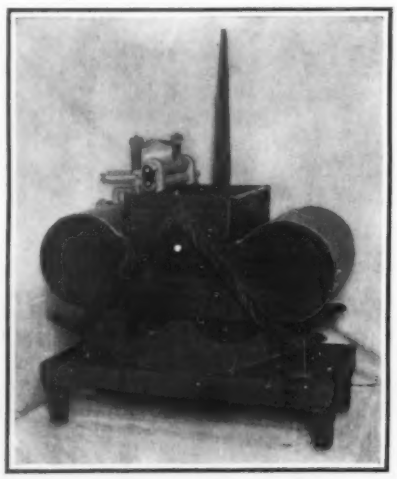
The zebu crossed with the American cattle has produced a new creature styled the cattabu, a name derived from its two parents. The cattabu is as immune from the Texas tick as is its sire. Its skin secretes a sort of wax which is distasteful to the tick. The cattabu also takes naturally to the marshes of the Gulf coast. It is believed that the creature will make possible the utilization of a great amount of waste land.

CATTABU CALF AND SIRE, THE SACRED BULL OF INDIA.

WASHING PAPER MONEY.

It is said that during the year 1909 paper bills representing $200,000,000 were removed from circulation and destroyed by the government. Much of this could have been saved and made as good as new had there been any suitable means available for washing the bills. The Director of the United States Bureau of Printing and Engraving has just purchased a bill-washing machine. The machine was originally built for washing clothes, and is so constructed that it automatically compresses air in chambers at the end of the box in which the material to be cleansed is placed, by a motion imparted to the apparatus from the upright handle. The compression of the air at the ends has a tendency to force the water through the articles placed in it, and it is by this process that the filth is quickly and perfectly removed from paper bills.

Only a moment is required to thoroughly cleanse a bill, so very effective is the machine's action, yet it will not tear or otherwise disfigure them.



MACHINE FOR WASHING BILLS.

Some very striking comparisons were made by the inventor when demonstrating his machine. Among them was one in which a very soiled five-dollar bill was torn in two, and one-half placed in the washer. After cleansing it was removed and pasted on the unwashed half. The comparison proved one of the strongest arguments in the favor of the washer.

Should the government finally adopt this system for laundering our money, the bills would be thoroughly washed in an antiseptic solution, then dried and pressed and a stiffening material added, so that the bill would return to circulation practically as good as new.

AN ELECTRIC ALARM THERMOMETER FOR FRUIT GROWERS.

Many thousands of dollars are saved by fruit growers in California and elsewhere by the use of smudge pots, which prevent damage by frost; and although this device has been in use for several years, a new improvement is the electric alarm thermometer, which automatically warns the rancher when the temperature reaches the danger point.

The alarm thermometer has a dial something like that of a clock with two hands, one of which registers the degrees of temperature, while the other hand is set at the danger point, ranging from 26 to 31 deg. F. for the various fruits and vegetables. When the hand which registers the temperature drops to the point indicated by the alarm hand, an electric bell rings automatically and keeps ringing. The thermometer itself is placed in the orchard, and the electric bell in the bedroom of the rancher of foreman, the connection being made by an ordinary electric circuit.

This device makes it unnecessary for the fruit grower to sit up all night during a cold spell and watch for the expected frost.

The smudge pots which are used in connection with this alarm thermometer are exceedingly simple, being medium-sized cans of sheet iron designed to hold crude oil. The pot is covered with an iron hood provided with perforations about the upper rim to create a draft when the oil is burning. This construction has the advantage of retaining the soot, so that the fruit will not be blackened, and it also makes it possible to regulate the flame so that it can burn longer, and prevents it from being blown out by sudden gusts of wind.

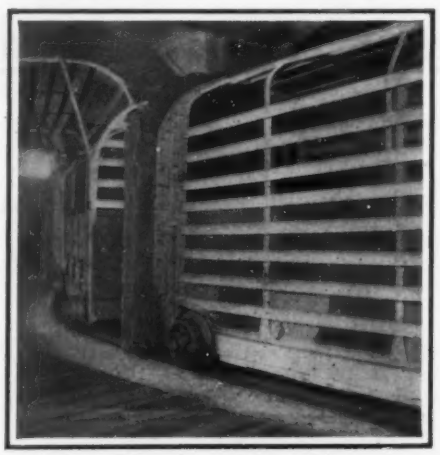
Only one thermometer is needed in the orchard, and about eighty or one hundred smudge pots per acre.

The object of these many fires is not only to prevent the fall of temperature in the orchard, but to set the air in motion, thus keeping the frost from forming. Large fires are not nearly so efficient as small ones.

FROST-WARNING INSTRUMENT AND SMUDGE POT.

PNEUMATIC TUBE RAILWAY AT CONEY ISLAND.

Old subscribers of the Scientific American will recall that many years ago Mr. Alfred E. Beach, editor of the Scientific American, constructed a pneumatic railway, under Broadway, New York, which was also the first subway constructed in this country. This principle is now in use for transporting mail from one part of this city to another, and in our large department stores for delivering cash. Recently, a railway working on the same principle was constructed at Coney Island for amusement purposes, and the accompanying illustration shows a car of this line about to enter one of the tubes. The railway consists of two tubes, the first of sheet iron, 900 feet long, and the second of concrete, 2,200 feet long. The ends of the tubes toward which the cars are moving are closed by vertically swinging doors, and a partial vacuum is formed in front of the car by means of exhaust fans driven by electric motors. The pressure which propels the car is ⅞ of a pound per square inch. The fans exhaust 80,000 cubic feet of air from the shorter tube, and 135,000 cubic feet from the second tube, in order to produce the necessary vacuum. The doors at the exit end of the tunnel are opened by a "kicker" located in the center of the track, which is engaged by the car as it approaches the doors. The cars attain a maximum speed of about 45 miles per hour. At curves, the speed is lowered by vents in the wall of the tube, thereby reducing the vacuum at such points. The speed of the car may be increased by a device located in the center of the track and operated by the car in passing, which serves to speed up the motors, thereby increasing the speed of the fans, and removing a greater amount of air from the tube.

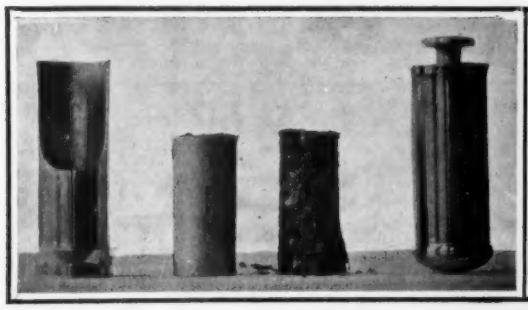


PNEUMATIC TUBE RAILWAY AT CONEY ISLAND.

AN AUTOMATIC PIPE FILLER.

Inventors have been busying themselves with attachments for and peculiar designs of tobacco pipes calculated to prevent the accumulation of moisture and to

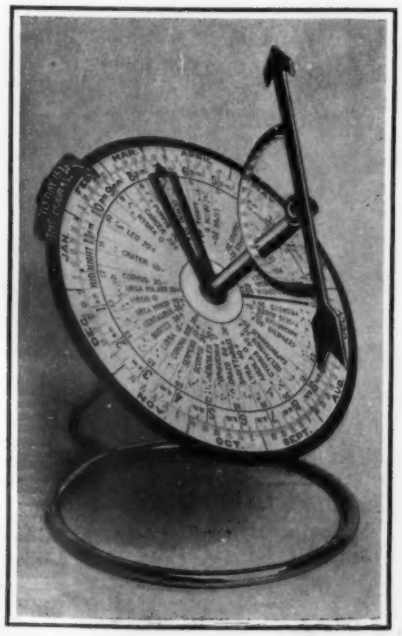
insure a free draft. Instead of effecting this result by modifications of the pipe, an Englishman has devoted himself to improvements in filling the pipe, believing that herein lies the solution of the problem. He has provided paper covered tobacco cartridges in which the strands of tobacco are laid quite straight. These are introduced into the bowl of the pipe by means of a filler, consisting of two parts—an inner tube, in which the cartridge is first placed, and an outer tube containing a plunger, which is placed over the inner tube and forces the tobacco into the pipe. In the process of using the filler, the paper covering of the cartridge is prevented from entering the pipe by means of five catches located at the mouth of the inner tube. It is claimed that a pipe thus filled will insure perfect combustion; that the tobacco burns to the bottom of the bowl, and that there is no accumulation of moisture; that there is no tendency of the tobacco to form into lumps, and that it will not rise when lighted, hence it does not need to be constantly pressed down.



INNER TUBE, CARTRIDGES, AND OUTER TUBE WITH PLUNGER. FILLING THE PIPE.

EQUATORIAL STAR FINDER.

It is always difficult for the novice to locate a constellation or a star by reference to a star map, this being due largely to the fact that certain stars which are of but slightly greater magnitude than others are made much more prominent relatively in the star map. The star map is merely a diagrammatical representation instead of an actual picture of the heavens. Another difficulty which besets the amateur is the fact that a star map shows the spherical surface of the heavens on a plane surface, and consequently there is a great deal of distortion in the relative positions of the stars. Amateurs who have had to contend with such conditions will appreciate the little device illustrated in the accompanying engraving, whereby one is able without any previous knowledge of astronomy to point to any of the constellations or principal stars. The device consists of two dials, one of which is fixed and is marked with the days of the year. The other dial is marked with the hours of the day, and bears on its face the principal constellations. In use a slide marked "To-day is" is set at the day of the month, and then the movable dial is turned until the hour comes up to the same slide. The arrow shown in the illustration is carried by a sleeve on the rod on which the dials are mounted, and is also free to swing on an axis at right angles to this rod. If it be desired to find a certain constellation, a pointer connected with the arrow is moved over the dial until the slot in the pointer uncovers the name of the constellation that is sought. Each constellation bears a number with the plus or minus sign indicating north or south declination. This indicates that the arrow must be swung on its axis until a pin on the sleeve is brought into register with the declination number on an arc carried by the arrow. This done, the arrow points to that part of the heavens in which the constellation lies. The principle, of course, is the same as that of the equatorial telescope. The rod on which the dials are mounted must lie parallel with the axis of the earth, that is, it must point directly toward the north pole of the heavens. The instrument may be used conversely to indicate the name of any bright star or constellation toward which the arrow is directed. It also shows sidereal time, which may be read off opposite the graduation for March 21st.



INSTRUMENT FOR POINTING OUT STARS AND CONSTELLATIONS.

MOTOR TRUCK ON THE FARM.

One of the largest nursery dealers in Rochester, which is the center of the nursery business, has purchased a 3½-ton electric truck for use during the shipping season to deliver trees and shrubs to the depot. On the return trip to the nurseries the truck is loaded with fertilizer and supplies. During the harvest season, the truck is used for harvesting the hay crop, as shown by the accompanying photograph, and also for the harvesting of the wheat crop. The capacity of the truck is nearly three times that of a horse-drawn truck. Where the time element in getting the wheat to the thresher is so important, the advantage of a motor over a horse will be readily appreciated.

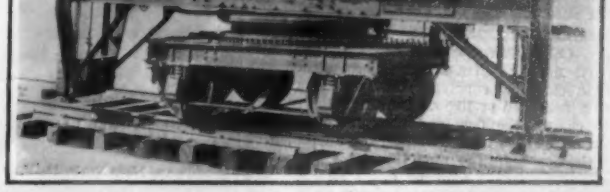
ELECTRIC MOTOR TRUCK USED IN THE WHEAT FIELD.

ELECTRIC COAL-LEVELING MACHINE.

The accompanying illustration shows a novel machine for leveling coal in beehive ovens.

The machine levels 195 ovens per day, finishing its task within one minute after the last oven is charged.

This electrically-operated leveler runs on the lorry track, uses the lorry trolley, and operates through the trunnel head, therefore no expense is required for its installation. It consists of a wheeled truck carrying a swinging frame, at one end of which is a vertically sliding leveling shaft, which drops down through the trunnel head, and can be raised up clear of the track when desired. The truck is driven by a 20 horse-power standard railway-type motor, geared to one of the axles. A similar motor is mounted on the swinging frame, which drives the leveling shaft and raises and lowers the same. The main vertical shaft is carried in a sliding crosshead, which is guided by vertical ways and is raised or lowered by means of two cables wound on drums mounted on a shaft driven by friction gearing. This leveling shaft is partially counterbalanced. By means of a hand lever, the friction gearing can be thrown in, raising the leveling shaft, or by dropping the lever a brake comes into action, holding the shaft at any desired height.



ELECTRIC COAL-LEVELING MACHINE.

SIGN WITH CHIPPED GLASS LETTERS.

In the SCIENTIFIC AMERICAN of July 2nd, we illustrated some arrowheads of flint and glass, which had been very cleverly chipped by Mr. George P. Riggs, with an ordinary ten-penny nail as a tool. Mr. Riggs has since executed a very novel sign, which is illustrated in the accompanying photograph. The letters of this sign are made of glass of different colors, some opaque and others transparent, and were chipped to form in the same way that the Indian chipped his arrow-heads. Particularly clever is the work on such letters as "A" and "R," which required that the glass be bored and then chipped on the inner periphery of the bore. The glass letters, as well as a number of arrowheads, are mounted on a black velvet background, and the effect is very striking indeed.

UNIQUE SIGN MADE OF CHIPPED GLASS LETTERS AND ARROWHEADS.

It is reported that work is expected to commence immediately on an important section of the railway to be constructed from Jinga, where the Nile at the Ripon Falls flows out of Lake Victoria, to Kakindu, a point beyond the rapids of that part of the Nile where the Victoria Nile becomes navigable. Although only some 50 miles in length, the new line, the construction of which lately received the sanction of the Government, will, by turning the rapids of the Nile, open up a valuable and productive portion of Uganda and establish connection with steam navigation on Lake Chioga and surrounding waterways. The new railway will be built under the direction of Sir Percy Girouard by the Uganda Railway Administration, and is expected to be completed by an early date.

RECENTLY PATENTED INVENTIONS.

Of General Interest.

SELF-RELEASING HOSE-RACK.—S. L. CRISSING, New York, N. Y. This invention comprehends a rack having a movable hasp temporarily locked in secure position, and encircling or partially encircling the hose which, for the time being, lies flat, the hasp, however, being adapted to swing directly outward when the hose is distended in consequence of water pressure within it, the outward swinging of the hasp completely releasing the hose.

HOSE-SUPPORT.—J. E. AUSTIN, Fresno, Cal. In this patent, the invention relates to hose supports for fire hose and the like, and has for an object to provide a tiltable rack for normally supporting hose, and provided with releasing means for releasing the said rack and permitting the same to tilt, thereby precipitating the hose to the floor or ground.

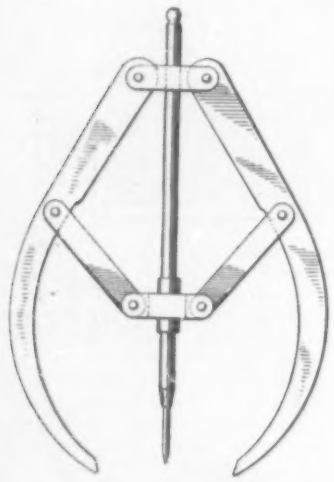
MEMORANDUM-RACK.—R. D. A. PARROTT, New York, N. Y. The object here is to provide a rack for use on a table or on a desk, and arranged to provide a convenient means for containing readily removable cards bearing legends relative to engagements for each day of the current month and the next following one, and to enable the user to quickly and accurately determine daily the engagements made.

STOCK-CHUTE.—F. H. MILLS, Edgewood, Cal. The main object of the inventor is to provide a device by which an animal may be securely held and thrown preparatory to branding, marking, etc. Ordinarily this is done by means of a rope or lasso, the use of which results many times in choking the animal or in causing it to struggle so that it becomes overheated and wrought up so that in many cases the animal's death ensues.

METHOD OF COVERING PIPES.—E. A. KELLAM, New York, N. Y. This pipe covering is used to prevent an interchange of heat between the surrounding medium and the contents of the pipe. The invention consists broadly of a plurality of non-conducting layers superposed one on the other in a successive manner around a pipe and in such a way as to form an efficient heat-insulating cover.

Hardware and Tools.

CALIPERS.—W. H. HARRIS, Box 615, Laurium, Houghton County, Mich. The purpose of the tool here illustrated is to provide means by which centers of bodies of different cross-sectional forms can be determined. The centering device does not have to be adjusted for each piece of work with which the calipers



CALIPERS WITH CENTER POINT.

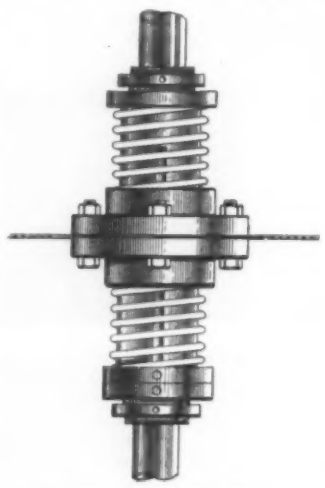
are used. The calipers are provided with the usual legs pivotally associated, and a centering rod connected with the legs which maintains a central position between them at all times. In the rod is a spring-pressed point that adjusts itself automatically to the body with which it is brought in contact.

Machines and Mechanical Devices.

MACHINE FOR SEPARATING FIBERS FROM THE PULP AND EXTRANEOUS MATTER OF PLANTS AND TREES.—E. BEHRENDT, Manila, Philippine Islands. The object of the present invention is to provide a machine for use in separating the fibers from the pulp and extraneous matter of plants and trees, notably tropical abaca (*Musa textilis*) in an effective manner and without danger of injury to its fibers or waste thereof, the fibers leaving the machine in a straight, clean and polished condition, completely free of gum and like substances.

LUBRICATING-VALVE.—T. J. BARBER, Denver, Col. This stop-cock or throttle-valve is particularly adapted for use as an attachment of a pipe line supplying fluid under pressure to a rock-drill or like device, the valve serving to control the flow and the pressure of the fluid, and also for controlling the admission of a lubricant to the pipe line by which it is conveyed to the drill or other device. The last may be steam, compressed air, or a liquid.

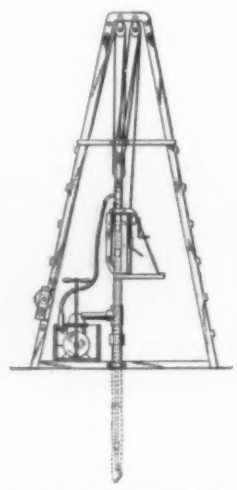
SLASHER-HEAD AND COUPLING.—FREDERICK W. GEBOTT, Harrison Mills, British Columbia, Canada. The device illustrated in the accompanying engraving relates to slasher-heads and couplings used in sawmills for cutting slabs and edgings in lengths, and has for its object to produce a device which will allow the saw to recede and release itself when



SLASHER HEAD AND COUPLING.

under side strain. The saw is carried by a collar splined to a sleeve on the shaft, and held central on the sleeve by means of a coil spring at each side, but free to move to one side or the other under strain.

WELL-BORING MACHINE.—P. A. BOUCHET, Merced, Cal. Among the principal objects which the present invention has in view are to provide a platform suspended upon a boring rod to assist in sinking the same; to provide means for regulating the amount of weight applied to the boring rod; to provide a rotary



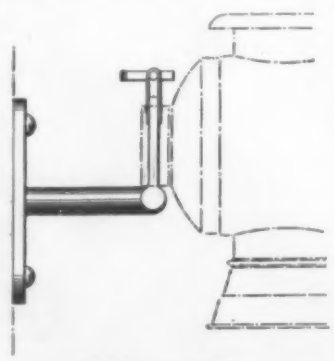
WELL BORING MACHINE.

head for the boring rod, suitably mounted in the structure of the platform, to be operated from the platform; and to provide a guiding structure for controlling the path of the head of the boring rod.

Vehicles and Their Accessories.

TRACE-SUPPORTER.—G. D. HOLM, Brady, Neb. The improvement is in a supporter such as is made a part of the ring or loop of the harness to which the back, crupper and hip straps are connected, and serving to carry the free ends of the traces when the latter are detached from the tree of the vehicle, either when the harness is applied or removed from the horse.

LAMP BRACKET.—H. C. ENGLEBERG, 5



SAFETY LAMP BRACKET.

Broadway, New York, N. Y. The lamp bracket here shown is adapted particularly for use on automobiles, and is provided with a guard adapted to prevent the lamp from loosening, should the socket work loose on the lamp post. The guard is pivoted to the post above the normal position of the socket and is heavier at one side of the pivot than at the other, so that should the socket work loose, it will be overbalanced by the vibration of the vehicle and will swing by gravity crosswise of the post to a locked position.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

WIRELESS TELEPHONES AND HOW THEY WORK. By James Erskine-Murray. New York: Norman W. Henley Publishing Company, 1910. 68 pp. Price, $1.

Mr. Erskine-Murray is a well-known lecturer on wireless telegraphy and telephony, whose contributions have appeared with more or less frequency in English technical periodicals. In this book he has given a semi-popular account of the development of the wireless telephone, its principles and its operation. For those who wish a clear-cut, concise treatment of the present state of the art, the book can be recommended.

HENDRICKS'S COMMERCIAL REGISTER OF THE UNITED STATES FOR BUYERS AND SELLERS. New York: S. E. Hendricks Company, 1910. Nineteenth annual edition. Quarto; 1,342 pp. Price, $10.

Some idea of the great value of this book may be obtained when it is stated that in the office of the SCIENTIFIC AMERICAN two copies are in constant use in the Query Department, two in the List Department, and one in the Advertising Department. It is doubtful if there is any book outside of a dictionary which could make the same showing. The arrangement is eminently common sense; the classification of the thousands and thousands of firms is excellent, and the use of the book is rendered easy by an excellent index. Many special lines of manufacture are listed under the trade name under which the article is sold. Thus, take for example steam and hot-water heaters. We find two pages giving the names of all the commercial boilers and hot-water heaters on the market which are used for house heating. This is only one instance of hundreds of other cases. This book is kept constantly up to date by an annual revision, which necessitates the sending out of many thousands of letters. Notwithstanding the fact that the five copies noted above are in constant use, it is very rare that a mistake of any description is found in this book. For the purchasing agent it is absolutely indispensable. There are over 50,000 names and addresses and upward of 37,000 business classifications. There is hardly an industry outside of a few special ones, such an manufacturers of textiles themselves, which are not treated in this book. It is especially devoted to the interests of the architectural, mechanical, engineering, contracting, electrical, railroad, iron, steel, hardware, mining, exporting, and kindred industries. It is indispensable as a buyers' reference for manufacturers, engineers, contractors, architects, governments, municipalities, jobbers, retailers, exporters, purchasing agents, and for railroad machine shops, mills, factories, mines, etc. The portly volume is always a most welcome visitor.

MODEL BALLOONS AND FLYING MACHINES. With a Short Account of the Progress of Aviation. By J. H. Alexander, M. B., A. I. E. E. New York: Norman W. Henley Publishing Co., 1910. 12mo.; pp. 127. Price, $1.50.

Mr. Alexander has given us in this book a very concise and helpful review of the present state of aerial navigation. He has, however, kept in mind the needs of the man who has more than a newspaper interest in aviation. For those who contemplate the construction of a model airship or flying machine, five sheets of working drawings, each sheet containing a different sized machine, have been provided. The arrangement of the book is excellent. It is divided fundamentally into two parts, one devoted to balloons and airships, the other to flying machines. The section on balloons and airships starts with an historical account of early balloon voyages, traces the development and use of the spherical balloon and the parachute, and then discusses the airship. A model fire balloon is described, as well as a model parachute and airship. The second half of the book discusses the fundamental principles of flight, typical biplanes and monoplanes, as well as model flying machines. A helpful glossary of terms used in flight, as well as suggestions for the building of a flyer, are included in the volume.

THE BOY AVIATORS IN AFRICA; or, An Aerial Ivory Story. By Capt. Wilbur Lawton. New York, 1910. 16mo.; 295 pp. Price, 50 cents.

At last we have a series of absolutely modern stories for boys. This is a live-wire narrative of peril and adventure in Africa. The Chester Brothers seem to fill a new niche in the field of fiction for boys. Unlike most books of this nature, notably one on Wireless Telegraphy, they are technically correct, and as the publishers modestly state, they are "wholesome, thrilling, and geared up to the third-speed" and are "clean-cut, real boys' books of high voltage." There are now six titles in the Boy Aviators series.

WHAT BECOMES OF THE SUNLIGHT AND HEAT ABSORBED BY THE EARTH? A Description of the Continuous Cycle of Operations of the Energy of the Solar System, and of the Cause of Gravitation. By James D. Roots, M. I., Mech. E., Thanet House, Temple Bar, London, W. C. London: Elson & Son, Printers, West Kensington, W. 1910. Price, One Shilling.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending September 27, 1910,

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Acetylene generator, C. W. Beck	971,346
Advertising or amusement device, W. Stott	971,091
Aerial machine, L. E. Clawson	791,358
Aeroplane, W. H. Fauber	971,030
Air compressing apparatus, L. B. De Camp	971,175
Air for use in metallurgical processes, treating, J. B. Miles	971,297
Air in closed rooms, device for damping the, K. Ulrich	971,227
Airship, D. Hillis	971,379
Ammonia, production of, Haber & Le Rossignol	971,501
Antiskidding device, emergency, F. A. Ruff	971,312
Apparel, ornamenting wearing, J. Luner	971,388
Automobile horn, L. B. Buchanan	971,169
Automobile radiator, F. G. Garrison	971,127
Automobiles, muffler cut out for, H. McCleary	971,458
Bag. See Chatelaine bag.	
Bag, O. A. Lehman	971,284
Balers, spring and power pull back for bay, G. Schubert	971,151
Baling presses, spring and power pull back for, G. Schubert	971,152
Ball mill or comminuter plate, H. D. Hibbard	971,196
Ball mill plate, J. M. Sherrerd	971,153
Band brake, B. B. Bachman	971,103
Barrel, metal, W. B. Goddard	971,439
Bearing, wheel, L. S. Strepey	971,417
Beater and scraper, flexible, J. W. Kohlhepp	971,049
Bed, invalid, J. M. Keller	971,381
Bed, window, L. P. Armstrong	971,016
Bedstead, Folding, Elliott & Schroder	971,433
Beet digger, A. Clark	971,253
Belt for windows, safety, M. Miller	971,062
Bill, J. C. Bell	971,106
Binder, loose leaf, J. N. Larsen	971,202
Binder, temporary, C. D. Graves	971,441
Blasting plug, Goodrow & Gooding	971,264
Boat, hydroplane, W. H. Fauber	971,029
Boiler, F. W. Meyer	971,296
Book or pad, triplicate manifolding, F. J. Krueger	971,283
Book record, B. W. Mulkey	971,396
Bookbinding, temporary, C. F. McBee	971,294
Bottle, non-refillable, L. G. Bugnon	971,488
Bottle rinsing machine, L. Weiscopf	971,231
Box making apparatus, L. D. Lewis	971,455
Braiding machine, R. C. Rahm	971,403
Brakes, pressure regulator for automatic, J. E. A. Michel	971,207
Broom, G. Dieckmann	971,362
Brush, L. H. Pfleghardt	971,306
Building block machine, H. Pocock	971,213
Building construction, T. J. George	971,035
Cameras, positioning and focusing indicator for enlarging and reducing, A. Fruwirth	971,367
Can body making machine, O. J. Johnson	971,278
Can cover, ice cream, M. Mansor	971,290
Can lock, milk, J. F. Billy	971,349
Can spout, powder, D. Locandro	971,055
Candy machine, F. H. Woolf	971,097
Car connection, electric, J. V. Doyle	971,363
Car door, flush closing freight, J. A. Patton	971,305
Car logging, W. T. Harding	971,444
Car seat head rest, H. W. Bowman	971,428
Car, tank, L. E. Allyn	971,102
Cars, signal bell cord hanger for, A. H. Marden	971,291
Carbureter, E. J. Gulick	971,038
Carbureters, air intake for, L. M. Fuller	971,034
Card case, roller, E. R. Sheppard	971,319
Case. See Card case.	
Catalytic body and making same, K. Schick	971,149
Centrifugal screen, W. R. Cunningham	971,174
Chain, power, C. W. Levalley	971,454
Chandelier for gas lamps, G. W. Cassidy	971,020
Chatelaine bag, W. H. Saart	971,411
Check, J. C. Bell	971,107
Check identifying machine, F. Hoffman	971,197
Cheese curd mill, C. Junker	971,197
Churn, J. N. Nail	971,466
Churn and butter worker, combined, L. A. Disbrow	971,178

Churns, butter collecting appliance for, S. Hartmann 971,041
Cigarette and cigar holder, Etcheverry & Figueroa 971,497
Circuit breaker, F. L. Sessions 971,982
Clamp, F. C. Gillitt 971,438
Clamp, F. C. Gillitt 971,310
Clock, watchman's, R. C. Rose....971,309, 971,310
Cloth stretching machine, G. Durrant..... 971,123
Clothes holder, V. A. Smith 971,086
Clothes washer, J. W. Whitely 971,232
Clutch, friction disk, G. F. Bowdle 971,168
Clutch, safety friction, J. D. Williamson, Jr. 971,335
Coffee mill, J. W. Stiger 971,084
Coin holder, F. G. Shumann 971,154
Coke furnace, W. Mueller 971,137
Collar, G. W. Ferguson 971,031
Collar for decoy ducks, L. J. Micka 971,392
Collar holder or retainer, A. L. A. Biddeloo 971,017
Concentrator or separator, G. W. Dennis 971,025
Concrete structures, reinforcement for, Brayton & Roberts 971,353
Condenser, steam, H. L. Brandon 971,486
Condensers, apparatus for removing gases and vapors from surface, Josse & Gensecke 971,505
Cooker, fireless, J. W. Flory 971,260
Corn popper, A. Danison 971,255
Counter guard bracket, J. B. Monette 971,300
Coupling. See Pipe coupling.
Coupling, B. F. Sparr 971,321
Crate, folding, Brockman & Hoffman 971,354
Crib hook, R. Luke 971,058
Cue tip, E. Lamprecht 971,201
Cultivator, wheeled hand, R. H. Dubourg. 971,121
Culvert, corrugated metal, J. R. Orwig .. 971,400
Culvert, road, W. F. Looker 971,456
Currycomb, J. S. Campbell 971,171
Curtain ring, E. Gilmore 971,263
Cutting mechanism, E. W. Cooper 971,022
Cutting tools, adjustable reversing attachment and feed for, J. H. Gebhardt 971,262
Cycle, motor, F. F. Bingham 971,166
Cylinders, controlling mechanism for working, H. C. Randall 971,143
Damper, air pipe, Leo & Bayer 971,285
Delivery mechanism, W. Scott 971,220
Dental instrument, J. L. Kelly 971,382
Differential speed motor, H. A. Rhodes 971,148
Display rack, W. H. Crane 971,493
Distillation system, water, A. Faget 971,183
Dolomite, treating, J. J. Gathy 971,368
Door fastener, C. Eytalis 971,498
Door lock, S. Schacht 971,314
Door lock, entrance, A. Arens 971,340
Door lock, mortise, D. W. Weed 971,333
Draft device, T. S. Moffett 971,393
Drag, road, F. Boeckmann 971,113
Drawing table, adjustable, G. A. Schnorr ... 971,061
Drill brace, J. S. Glenn 971,037
Driving mechanism, J. Dnitch 971,364
Drying machine, T. F. Dexter....971,176, 971,177
Dust collector, F. J. Matchette 971,390
Dust remover, Lewis & Reynolds 971,054
Dye, bluish-gray vat, P. Thomaschewski et al 971,224
Dye, brown vat, P. Thomaschewski et al ... 971,225
Dye, trisazo, Blank & Bergdolt..971,111, 971,112
Educational appliance, L. T. Freeman 971,185
Electric conduit fitting, W. C. Robinson .. 971,216
Electric drop light fixture, adjustable, H. W. Lawrence 971,203
Electric light globe holder, A. I. Chandler .. 971,490
Electric light, portable, J. Block 971,241
Electric light support, T. Gray 971,192
Electric switch, G. B. Thomas 971,419
Electroller, J. W. Turner 971,226
Embroidering machine, crank hemstitch, D. Noble 971,140
Engine. See Rotary engine.
Engine cooling device, internal combustion, R. B. Vaughn 971,328
Engine igniter, gas or other internal combustion, G. Z. Smith 971,413
Engine muffler, internal combustion, J. M. Werner 971,424
Engine regulating apparatus, C. H. Smoot 971,088
Engine starter, internal combustion, D. S. Anthony 971,482
Engines, transmission and steering mechanism for traction, Peterson & Schelling .. 971,471
Envelop, safety, A. Mieden 971,461
Eucalyptus oil solution and manufacture thereof, A. M. Cox 971,359
Evaporator, J. E. Dunn 971,258
Evaporator feeding device, A. S. Morris, 971,394, 871,395
Explosives, trinitrotoluene mixture for, J. G. Nathurst 971,211
Eye, schematic, H. L. De Zeng 971,026
Eyeglass connection, C. Billington 971,348
Facial lines and defects, device for removing, E. Hannig 971,373
Faucet, S. A. Dennis 971,361
Faucet closing device, A. E. Redlich 971,473
Faucet, glue, C. M. Zimmerman 971,337
Feed water regulator, boiler, Cade & Knapp 971,357
Fence post, W. Hooper 971,270
Fertilizer distributer and seeder, combined, W. J. Adams 971,338
Fiber yielding materials, reducing, G. H. Marshall 971,457
Filament, metallic, I. Kitsee 971,385
Filament, metallic incandescent, A. Lederer 971,452
Files and the like, machine for cutting, J. Neill 971,066
Filing device, credit account, W. Eacrett .. 971,495
Finger protector, M. L. B. Ward 971,693
Fire escape, G. H. Johnson 971,276
Fire extinguisher system, automatic, T. J. Stanklewicz 971,089
Fire extinguishers, chemical tank for, J. T. Lally 971,386
Firearm muffler, A. C. Shipley 971,083
Firearm sight, H. L. Lovejoy 971,287
Fish screen and sluice box, A. J. Collar ... 971,492
Flax, retting, P. Riva 971,076
Floor covering holder, D. Wolcott 971,511
Floor dressing machine, G. F. Hall 971,443
Fluid pressure regulator, M. Jaspersen 971,275
Flume or conduit, W. J. Smith 971,087
Fly trap, Redden & Cunningham 971,404
Flying machine, M. Ackerman 971,235
Folding box and crate, Johnson & Bowman 971,279
Foot and leg rest, J. A. Gaertner 971,279
Fountain comb, G. M. Charles 971,250
Funnel, C. J. Wilson 971,233
Furnace, P. Stipp 971,416
Furnace casing, W. F. Hansen 971,269
Furnace door, G. de Grahl 971,268
Furnace grate, Baillot & Menager 971,104
Furnaces, tapping element for melting, H. L. Hartenstein 971,445
Fuse mounting, W. Mers 971,205
Game apparatus, S. E. Creasey 971,024
Game apparatus, W. Peall 971,470
Game table cover, coin controlled, J. M. Stivers 971,222
Garment, storm, L. V. Benoit 971,110
Gas apparatus, Cappon & Schantz 971,019
Gas burner, J. H. Carver 971,117
Gas burner for heating purposes, G. B. Damon 971,429
Gas cleaning apparatus, D. S. Anthony .. 971,481
Gas controller, F. E. Youngs 971,099
Gas producer, W. B. Hughes 971,271
Gaseous fluid mixer, Webb & Stickels 971,332
Governor, engine, C. B. Edwards 971,431
Grain heater agitator, A. J. Koegler 971,048
Grain heater agitator, F. A. Wegner 971,480
Grain heaters, device for regulating the discharge of, F. A. Wegner 971,479
Grape, etc., picker, C. A. Freitag 971,186
Grates, heating attachment for open, C. H. McCall 971,063
Grinder, sickle, J. P. Kine 971,449
Grinding machine, W. J. Bell 971,108
Gripping device, W. D. Roop 971,080
Hammer drill, A. H. Taylor 971,223
Harness, J. O. Adams 971,426
Harrow, H. A. Wetmore 971,425
Harrow, rotary, S. Schaller 971,218
Harvester and other comb machine, tripper, R. B. Douglas 971,180
Harvester windrow attachment, beet, A. Clark 971,254
Hat fastener, lady's, A. Reim 971,474
Hat flanging machine, A. B. Waring 971,094
Hat pin holder, G. C. Bassett 971,484
Hay fork, W. S. Thompson 971,324
Headlight, vehicle, B. R. Gover 971,265

THE "CLEMENT-BAYARD II."
(*Continued from page 273.*)

somewhat smaller "Ville de Pau," "Col. Renard," "Ville de Nancy," "Ville d'Orleans," that followed, fell a little below the standard of this "model," but the type lending itself easily to enlargement, the new giant "Clement-Bayard II." not only promises to surpass the "Clement-Bayard I." quite as much as the latter excelled the "Ville de Paris," but fully to equal the splendid German craft of its own class, and restore to France her old position as an air power, which at present rests rather too exclusively on her proficiency in an auxiliary navy of aeroplanes. The government seems fully aware of this state of affairs, for not only did it crush a British option on the "Clement-Bayard II." and step in to acquire that craft itself, but it is understood that all the proposed new French aerial dreadnoughts will be of this type, to excel the old "Lebaudies" threefold in size.

Though France may thus soon have a very efficient air navy, she cannot deny that during her temporary inactivity the very features in which the "Clement-Bayard II." most differs from former French designs have been anticipated in Germany and Italy. Von Parseval first found that ideal position for propellers in airships which are not entirely rigid on a frame that projects above the car. All large twin-screw airships of this type have now adopted his plan—the "Parsevals," the "Gross Basenachs," and also the smaller Italian military dirigibles. Even the last Lebaudy, the "Libérté," has an oblique propeller frame.

The other special feature of "Clement-Bayard II." originated in Italy. It consists in arranging the stabilizers of a dirigible with a long slender stern in the form of a boxkite. It seems that the imitators of Col. Renard in the beginning defeated their own ends by too thoughtlessly adopting a rather abstract idea of his—that of making the stabilizers gas-inflated appendages of the balloon itself. They thus obtained not only too much drag from these bags themselves, but they sacrificed that other great accomplishment of Renard's, the beautiful fish-shape of "La France" of 1884. The new "Clement-Bayard" has now so efficiently revived this form, that at a distance it might be taken for "La France."

It is now known that a boxkite arrangement as well as anything resembling it, causes much drag. Friction plays an important part in modern aero-dynamics. It seems that a mass of air inclosed, as it were, in part of a box, subject to friction from many sides is more or less dragged along with the surfaces, as a whole. Boxtails on biplanes are disappearing, the speedy monoplane is daily gaining friends. The "Deutschland" of Count Zeppelin showed a substantial gain in speed when it was provided with a single enlarged stabilizing surface in place of two superposed ones. Thus it would seem as if boxkite tails for airships were rather inefficient. But on hulls with a very slender stern, which are not completely rigid, it would be structurally difficult to display enough surface in the rear without superposing and juxtaposing many planes. At the same time in this very shape a drag has rather a beneficial stabilizing effect, like that of the tail of an old-fashioned elongated kite.

It must be conceded that the "adopted" features of "Clement-Bayard II." are beautifully amalgamated with the original "La France" design, the standard of perfection for her type. The sweet, unimpaired lines of the hull are now favorable to high speed; the absence of a front propeller has left room for an improvement in the suspension, which leaves the hull, formerly so distorted, now as shapely as though it were turned on the lathe out of solid wood. There is a great saving of weight in transmissions and propellers. The machinery is now concentrated almost directly below the center of lift. The propellers are placed

(*Continued on page 284.*)

Heater, A. H. Merrill	971,134
Heater and radiator, combined, E. V. Bentley	971,347
Heating apparatus, J. A. Almirall	971,165
Heating system, P. E. Wullschleger	971,336
Heating system, steam, A. G. Paul	971,070
Heating unit, electric, T. Van Aller	971,102
Hides, apparatus for treating, dehairing, swelling, and tanning, A. Fay	971,126
Hinge, spring, Keene & Schuster	971,281
Hitching and releasing device, J. Robinson	971,078
Hoist brake and clutch adjuster, automatic, H. T. Herr	971,377
Hollow article mold, Kerr & Smith	971,045
Hook. See Crib hook.	
Horizon, artificial, J. W. Gillie	971,189
Horseshoe, H. B. McCormick	971,138
Horseshoe attachment, N. A. Bender	971,109
Humidifying apparatus, W. H. Carrier	971,428
Hydrocarbon burner, W. W. Case, Sr.	971,489
Hydrogen, producing, A. Messerschmitt	971,206
Incubator, H. R. Parker	971,212
Indexing device, B. F. Morrill	971,464
Indicator, T. G. Leavell	971,072
Indicator, W. G. Wolfe	971,096
Induction motor, synchronous, C. A. Lohr	971,056
Ink for ceramic transfer pictures, J. Kasseker	971,280
Insect collector and destroyer, W. J. Greer	971,193
Insulator, mine, C. W. Speakman	971,322
Ironing table, J. W. Mills	971,462
Journal brass, H. J. Small	971,085
Key lever cup, K. Landa	971,050
Keyhole guard, G. M. Dunlevy	971,122
Keyboard, F. Clutsam	971,172
Kneading and mixing machine, J. Lips	971,387
Knife or tool for tapping rubber and other gum trees, Cater & Schofield	971,021
Label applying machine, H. F. Maynes	971,133
Lamp, F. M. Stevens	971,323
Lamp and lantern extinguisher, B. Kovacic	971,282
Lamp, berth, W. J. Bohan	971,351
Lamp holder, O. Krug	971,131
Lamp, incandescent electric, A. Lederer	971,453
Lamps, heater attachment for gas, H. F. Blum et al	971,243
Lantern holder, A. C. Hewitt	971,378
Lard extractor, C. H. Ritter	971,408
Lasts, latch for hinged, F. W. Kittlinger	971,200
Lathe, G. O. Gridley	971,370
Lathes, relieving attachment for, E. W. Blum, et al	971,243
Leather working machinery, spraying device for, Elderkin & Rose	971,365
Level, adjustable, H. A. E. Coy	971,360
Life saving apparatus, J. A. Jakobsen	971,273
Lifting jack, Loetzer & Goodbow	971,286
Lifting jack appliance, A. W. Sallander	971,217
Light. See Electric light.	
Light striker, R. von Horwath	971,380
Liquid concentrating apparatus, P. Kestner	971,383
Liquids in measured quantities, apparatus for distributing, S. Effantin	971,259
Lock, F. Walters	971,423
Locomotive exhaust nozzle, means for automatically adjusting, W. C. Allison	971,339
Logotype, type bar, and typographic form, F. H. Richards	971,074
Loom for weaving pile fabrics, needle, J. C. Brooks	971,355
Loom for weaving short weft fabric, H. E. Rathbun	971,072
Loom, needle, J. C. Brooks	971,487
Lubricating and disengaging cutting tools, means for, C. H. A. F. L. Ross	971,410
Magnetic separator, B. E. Wood	971,163
Mail chute, F. E. Anderson	971,015
Manicure article, combination, R. M. Luce	971,057
Manure spreader, I. A. Funk	971,436
Marking and trimming device, Meland & Moe	971,460
Meat block, revolving, J. F. Malone	971,389
Mess kit, C. A. Dodge	971,179
Metal bodies, producing compound, J. F. Monnot	971,135, 971,136
Metal sheets, apparatus for producing corrugated, G. B. Johnson	971,277
Meter system, J. A. Tilden	971,510
Mining drill thread bolt and support, G. W. Nixon	971,467
Mining machines of the cutting chain type, bit for, C. N. Barton	971,345
Mixer, W. H. Larkin, Jr.	971,051
Mold, C. D. McArthur	971,391
Molding device, J. Rial	971,407
Motor control system, L. Janisch	971,199
Mounting, G. W. Dover	971,181
Music and the like leaves, apparatus for turning, W. R. Lyttleton	971,204
Musical instruments or orchestrions, tracker for automatic, A. L. Mustel	971,465
Musical instruments, tracker board for mechanical, J. O'Connor	971,398
Nest, trap, Pennington & Raymond	971,401
Nut lock, Cornelius & Dean	971,023
Nut lock, E. Schnelle	971,150
Nut lock, A. Le Blanc	971,451
Oil cup, thermostatic, E. J. Grant	971,440
Oils and the like, treatment of hydrocarbon, J. Nord	971,468
Oils for combustion purposes, treating, F. Rademacher	971,142
Oiling cauls, apparatus for, A. S. Nichols	971,397
Optometer, I. Fox	971,499
Ore dressing machine, H. G. King	971,046
Ores bearing precious metals, treatment of, J. C. Clancy	971,251, 971,252
Organ pipe, W. E. Haskell	971,502
Organifying apparatus, C. S. Bradley	971,244
Packing, piston rod, F. N. Mason	971,292
Padlock, T. Remlinger	971,406
Paper machines, suction box vacuum regulator for, W. H. Millspaugh	971,298
Paper rack, wrapping, J. H. Svenstrom	971,315
Paper trimming machines, slot guard for, M. Repp	971,146
Party line indicating system, C. C. Bradbury	971,352
Pencil clip, W. B. Goode	971,190
Photographic apparatus, Hutteball & Morier	971,447
Picker. See Grape, etc., picker.	
Picture machine, moving, A. E. Smith	971,155
Picture machines, film reel for moving, T. Sharlow	971,317
Pipe cleaning apparatus, water, Hill & Hodgman	971,042
Pipe coupling, train, T. Reynolds	971,147
Pipe hanger, E. H. Roberts	971,077
Planter attachment, corn, J. S. Smith	971,320
Planter, corn, H. F. Carter	971,116
Planter, corn, Mauger & Schraw	971,293
Plow, R. M. Kemp	971,448
Plow, reversible multifurrow disk, D. H. Smith	971,157
Pool ball rack, G. F. Goss	971,128
Potash, preparing caustic, H. Reitz	971,145
Potato cutting and planting machine, S. E. McKnight	971,064
Printing press feeder, Brewer & Cheshire	971,245
Propeller, T. Roggenbuck	971,409
Protective screen for apparatus which are exposed to high temperatures, G. Egly	971,124
Pulley, F. E. Buxton	971,356
Pump or air compressor, rotary, C. R. Gether	971,188
Radiator or other heating device operated by gaseous fuel, Davis & Twigg	971,119
Rail tie and rail fastener, I. C. Cattan	971,118
Railway cross, bridge, and switch tie and fastening, metallic, J. W. Clubb	971,491
Railway frog, A. Hollinger	971,129
Railway joint chair, P. Radoman	971,308
Railway safety system, electric, A. Casale	971,429
Railway switch, F. P. Ahman	971,236
Railway tie, C. Livingood	971,132
Railway tie, J. Dematteis	971,256
Razor blade holder, J. E. Dube	971,257
Razor strop clamp, A. Eisner	971,432
Receptacle cover, B. F. Kramer	971,509
Reclining chair, adjustable, A. D. Luedders	971,288
Recoil loader with fixed barrel, P. Mauser	971,061
Refrigerating system, E. T. Winkler	971,162
Refrigerating system, A. Faget	971,182
Refrigerator car, A. W. Watson	971,478
Refrigerator mounting, F. Lutz	971,059
Regulator. See Feed water regulator.	
Riveting machine, W. Baker	971,483

WANTED.—One second-class laboratorian at $4.48 per diem, one third-class laboratorian at $3.84 per diem and one fourth-class laboratorian at $3.28 per diem. A competitive examination will be held October 19, 1910, for the purpose of filling the above positions. For further information address "Commandant, Navy Yard, Washington, D. C."

WANTED.—Expert aids, architectural draftsmen, structural steel work draftsmen, electrical draftsmen, mechanical draftsmen, and sub-inspectors. A competitive examination will be held simultaneously at the Navy Yards, Portsmouth, N. H., Boston, Mass., New York, N. Y., Philadelphia, Pa., Washington, D. C., Norfolk, Va., Charleston, S. C., Pensacola, Fla., New Orleans, La., Mare Island, Cal., and Puget Sound, Wash., and at Chicago, Ill., Cleveland, Ohio, Pittsburg, Pa., St. Louis, Mo., Atlanta, Ga., and Chattanooga, Tenn., October 17 and 18, 1910, for the purpose of establishing an eligible register for the above positions. Applicants desiring to take the examination at any of the Navy Yards will address their applications to the Commandants of such Yards. Those wishing to take the examination at Chicago, Ill., Cleveland, Ohio, Pittsburg, Pa., St. Louis, Mo., Atlanta, Ga., and Chattanooga, Tenn., will address their applications to the Secretary of the Navy, Washington, D. C. All applications must be delivered to the proper officer on or before October 10, 1910.

CONTRACTORS

Bids are invited for construction, equipment and operation of the Tri-Borough Subway and Elevated System of New York City, comprising about 44 miles of line, to be opened October 20, 1910.

Bids are also invited for construction only, with municipal money, to be opened October 27, 1910. Bids may be made for one or more of the sections into which the construction work has been divided.

Write or call concerning full details, including forms of contracts and plans.

PUBLIC SERVICE COMMISSION
For the First District
154 Nassau Street, New York City

OUR AVIATION NUMBER

On October 22, 1910, there will be an international aviation meeting at Belmont Park, New York, the most important that has ever been held, either in this country or abroad.

Tens of thousands of people who never saw a flying machine in the air will attend that meeting. The newspapers will publish articles and pictures about the men who are flying.

The SCIENTIFIC AMERICAN, will be the only paper in which the inquiring reader who wants to know how flying machines fly, why they differ in type, why they are constructed as they are, will find just the information he wants. For the SCIENTIFIC AMERICAN will issue a special aviation number with a colored cover, bearing date October 22d, to commemorate this highly important international event.

The number will be nearly twice as large as the regular SCIENTIFIC AMERICAN. It will be packed with instructive and thrilling pictures of the leading types of aeroplanes in existence to-day.

Among the articles will be descriptions of the leading types of machines illustrated with carefully prepared wash drawings in which every part of the machine is lettered so that its construction and operation can be understood at a glance; an article on the flying machine of the future, accompanied by an illustration in which the probable appearance of the machine which the racing man of ten or fifteen years hence will use, if we have correctly interpreted the present tendencies in construction; an article on learning how to fly, in which the methods of the French aviators and constructors are described, as well as the new machines which have been devised just for the purpose of teaching a man how to fly. The difficult art of flight is set forth lucidly, and the various means of maintaining stability (wing-warping, ailerons, etc.) are described. There will be a brief history of the art of aviation, in which credit is given where credit is due.

The number will be published primarily in the interest of people who want to know enough about flying machines to understand their construction and operation without delving through dull technical articles.

Simplicity of expression, heightened by picturesqueness of presentation, will characterize this number.

PRICE TEN CENTS AT ALL NEWSTANDS

MUNN & CO., Inc., Publishers, 361 Broadway, New York

(*Continued from page 283.*)

far enough to the side so that they cannot drive the air against the car, thus saving considerable power. The mounting of the system of stabilizing and steering planes in the rear is ingenious. The suspension frame or car is there continued upward and backward, spreading like a fan, and made to form one piece with the frame of the multiple "boxkite."

This is very similar to the principle embodied in "La France," which had two horizontal fins mounted on the rear of the frame. A single vertical fin of trapezoid form is held by the suspension cables closely above the "boxkite." These many vertical fin surfaces seem here, as in the Italian dirigible, to prove that a very slender stern, while giving fine speed, needs much steadying.

That there are two motors in the "Clement-Bayard II." in place of one, is a remarkable innovation from the French point of view, but since three and four motors are becoming quite common in the German leviathans, they can hardly call for more than a passing comment. At least two motors seem indispensable for the rough weather aircraft of the future.

A characteristic French improvement is the mounting of the motors on inverted carriage springs to take up vibration.

In its present form the "Clement-Bayard II." seems a wonderful ship in the air, but its relations to the ground appear in a way more "compromising" than those of a rigid Zeppelin were once believed to be.

The suspension frame, which also represents the car, and which is heavily loaded at some points, must come in direct contact with the ground along its whole length in landing. More serious seems the fact that the horizontal rudders at the rear end cannot exert any aeroplane effect to relieve the shock, and that the great length of the low-hanging suspension frame prevents altogether any dynamical lifting or ballasting while the ship is close to the ground. These effects can be obtained only if the axis of the ship is so much inclined that the long frame would first touch ground with its weakest point. As a matter of fact it has been damaged from time to time in landing during the trial trips, once quite seriously. The craft should certainly have elastic buffers like the cars of Zeppelins.

The hull of the "Clement-Bayard II." is 251 feet long and it displaces 247,000 cubic feet of air. The frame has a length of 157 feet 5 inches, and hangs 22 feet 11 inches below the balloon. Each propeller has a diameter of 19 feet 8 inches. The horizontal planes have a surface of 592 square feet. The ship is propelled by 250 horse-power, 125 horse-power in each motor. The frame is made of steel tubing and reminds one of Santos-Dumont's structures in its triangular section. The car spaces are formed by a forking and doubling of the frame's upper "back bone," and are of a very comfortable width. The division into "bridge," "cabin," and "engine room" is similar to that of the "Clement-Bayard I.," and so is the whole system of suspension, ballonet, blower, etc. The mounting of two motors side by side makes the engine room just as shipshape and compact as on the "Parseval," type B. The vessel has a floor of corrugated aluminium. Transmission is by bevel gear and shafts as in the "Parseval III." and the "Libérté." The frame of each propeller forms a four-sided pyramid with a wide base and combines great strength with slight air resistance and small weight. The unobstructed strong nose of the frame furnishes an excellent fastening point for anchor cables.

Long before this fine ship was completed, a trip from Paris to London was made the most prominent feature in the program of its performances. It was to take place as early as last May, but is still unrealized. In view of the novelty of the design, French unfamiliarity with larger ships, and especially the present imperfect provisions for landing, the

(*Concluded on page 285.*)

Rock pulverizing machine, J. B. Rossman	971,311
Root puller, G. T. McGehee	971,458
Rotary engine, W. M. Hoffman	971,043
Rudder, W. R. Bennett	971,240
Sad iron, J. L. Ennis	971,125
Safe having coin operated lock, M. Ebner	971,366
Safe or vault, C. Bartel	971,344
Safety limit switch, W. W. & G. A. Pierce	971,307
Sandpapering machine, L. H. Breckenkamp	971,114
Sash hanger, H. P. Sarchett	971,313
Sash lock, E. Blossfeld	971,350
Saw set, J. Rogers	971,079
Saw set, L. W. Parkhurst	971,141
Screw cutting die head, W. Neumann	971,303
Seal, envelop, F. Shannon	971,316
Seat frame, H. S. Hale	971,371
Seeder, C. J. Stein	971,090
Separating heterogeneous substances and detinning scrap, C. J. Reed	971,405
Settee, S. F. Balentine	971,342
Sewing machine stitch forming mechanism, J. P. Weis	971,229
Sewing machines, differential attachment for J. P. Weis	971,230
Shade bracket, P. Rabideau	971,214
Shades, swinging support for window, M. J. Smith	971,414
Shipping and display box for food products, J. J. Lynch	971,060
Shoe tree, J. G. McNair	971,210
Shoveling machine, C. L. Glass	971,036
Shuttle, J. Gagnon	971,187
Sifter, ash, T. P. Bolger	971,018
Sifting shovel, J. Moller	971,299
Singeing machine, T. Allsop et al	971,427
Skates and the like, wheel for roller, Yozall & Easthope	971,164
Sled propeller, W. R. Murphy	971,302
Snow plow, rotary, C. B. Mann	971,289
Soda, preparing caustic, H. Reitz	971,144
Sodium, manufacture of metallic, P. L. Hullin	971,198
Sound recording and reproducing machine, G. Oulton	971,068
Sowing machine, seed, A. Welsh	971,331
Spectacles, eye-shield for, F. Hamilton	971,372
Speed indicator and faucet control, combined, K. K. McLeod	971,139
Speed mechanism, variable, H. W. Schatz	971,219
Spool holder, A. Musg	971,209
Spring constructed with india rubber, buffer and other, A. G. Spencer	971,415
Spring wheel, F. C. Oldham	971,067
Springs, machine for forming loops on coil, C. R. Barrett	971,238
Stacker, pneumatic, J. A. Walsh	971,329
Stage effect, F. D. Thomas	971,418
Stamping machine, Jessup & Muth	971,130
Steam and water gage, E. Halley	971,208
Steam engine, Psareas & Parkas	971,402
Stirrup, safety, P. G. Helsing	971,376
Sunshade, C. I. Howard	971,503
Sweeping machine, L. Soos	971,158
Switch. See Electric switch.	
Talking machine sound reproducing device, L. Griffith	971,442
Tank closure, B. A. Lake	971,450
Telegraphy, C. G. Burke	971,170
Telephone, J. W. Atlee	971,237
Testing clamp, M. J. Gray	971,191
Thawing furnace, portable, T. D. Bausher	971,105
Threshing machine, C. L. Bean	971,239
Tide motor, D. M. Barr	971,343
Tie tamping machine, J. Iliff	971,504
Tile and saggar, combined, G. E. Vance	971,160, 971,228
Tire bolt cutter and nut turner and splitter, G. Heller	971,195
Tire casing, J. W. Moore	971,301
Tire protector, pneumatic, O. A. Bricteon	971,246
Tire, wheel, S. Grunewald	971,267
Tool holder, boring, C. E. Day	971,120
Tool shank, G. E. Hackett	971,039
Tools, machine for shaping heavy, E. N. Mills	971,208
Tooth crowns, means for forming, F. O. Jaques, Jr.	971,274
Top spinning device, C. C. Tannert	971,420
Trolley, J. & J. Orszag	971,399
Trolley car pole attachment, G. R. Dunn	971,494
Trolley harp, L. E. Brault	971,485
Turbine, elastic fluid, C. R. Waller	971,092
Turn table, G. A. Bronder	971,115
Type casting machine attachment, A. W. Hanmaker	971,040
Typewriter, J. W. Paul	971,469
Typewriting machine, Forbes & Rothwell	971,032
Typewriting machine, C. B. Yaw	971,098
Typewriting machine, O. Woodward	971,234
Umbrella attachment, G. D. Cory	971,173
Vacuum cleaner, W. H. Rakestraw	971,215
Vacuum cleaner, hand, C. G. Hutchinson	971,044
Valve, air brake protection, W. V. Turner	971,326
Valve, cut-off, Mesnar & Shay	971,035
Valve, device, triple, W. V. Turner	971,327
Valve for fluid operated motors, controlling, C. A. Parsons et al	971,089
Valve, graduated release triple, W. V. Turner	971,421
Valve mechanism for compound engines, P. O. Poulson	971,472
Valve, steam pressure reducing and controlling, N. Filiberto	971,135
Valve, stop, C. O. Hawkins	971,446
Valve, ventilating, G. E. Knowles	971,047
Valves, device for facilitating the removal of engine, O. A. Hays	971,375
Varnish for coating leather, apparatus for manufacturing, G. W. Priest	971,071
Vehicle controlling mechanism, J. T. Whalen	971,334
Vehicle draft attachment, motor, O. E. Ritzmann	971,075
Vehicle spring suspension arrangement, Rennen & Romeiser	971,475
Vehicle wheel, C. Kindscherf	971,384
Vehicle wheel, J. H. Esders	971,434
Vehicle wheel, cushioned, M. H. Aldridge	971,100
Veil holder or retainer for bonnets, J. Rostenberg	971,476
Ventilating system, A. L. Werner	971,161
Ventilator. See Window ventilator.	
Vibration and sound, plate for deadening, Genest & Stossel	971,369
Voltage regulator, R. Fleming	971,184
Wagon box protector, N. P. B. Eskildsen	971,028
Wagon front gear, G. Kautz, Sr	971,507
Wall and the like, brick, W. Stanway	971,159
Washing machine, J. P. Dorau	971,027
Watch movement ratchet mechanism, W. H. Ehelhare	971,496
Watch movement ratchet mechanism, H. M. Groff	971,500
Watchcase bow, B. Levy	971,053
Water heater, W. L. Blackwell	971,167
Water wheel stop, W. D. White	971,095
Weather strip, S. F. Haskell	971,374
Web roll tension device, G. F. Read	971,073
Welding burner, A. D. Drager	971,430
Well strainer, driven, C. G. Smith	971,156
Wells, tile setter for, A. H. Klucking	971,508
Wheel. See Spring wheel.	
Wheel, R. D. Moon	971,463
Wheel rim, vehicle, E. C. Shaw	971,318
Window frame, F. E. Frisbee	971,261
Window screen, A. H. Newpher	971,304
Window screen, Walrath & Austin	971,422
Window screen, E. H. Talbert	971,477
Window ventilator, J. B. Scureman	971,412
Wire cutter, T. A. Briggs	971,247
Wire stretching clamp, O. J. Nederlee	971,065
Wood preserving solution, F. Hasselmann	971,194
Wrench, F. A. Trahin	971,325
Wrench, Bajusz & Kondas	971,341
Wrench attachment, O. H. Ford	971,033
Writing machines, cushion cap for the keys of, H. H. Shepard	971,221

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since October 4th, 1859, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., Inc., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., Inc., 361 Broadway, New York.

(*Concluded from page 284.*)

"Clement-Bayard" has wisely made only short trial trips. The machinery must be studied in action, the landing problem mastered, and especially a captain (Lieut. Tessier) must be trained.

The ship has shown excellent speed; 24 miles are said to have been covered on a round trip in 30 minutes in the beginning of June.

THE EARLY DAYS OF SUBMARINE WARFARE.

(*Continued from page 277.*)

ous Friar Bacon too wrote about divers and their air tubes. Underwater attack was fully recognized in the Middle Ages. One of the ten maxims relating to naval warfare which were in almost universal use ran: "Let your divers with augers pierce the ship's sides; in order to hasten her destruction, you must hurl great stones at the place where the water is entering." It is likely that the divers employed on a risky job of this kind wore some kind of a special head covering, possibly with a short length of tube communicating with the air; and it may be that the "ten kettelhattes" in the inventory of the stores belonging to the "Christopher of the Tower," one of Edward III.'s principal ships, were divers' helmets. It is not known just what they were, but it may be mentioned that the first diving bell experimented with at Toledo in 1538 is termed a "kettle," by a writer who was present.

"The warriors of the sea were always distinguished by their intrepidity and boldness," says a French writer; "and it is easy to believe that from them emanated the system of submarine warfare that in the fifteenth century gave birth to an extraordinary series of inventions in nautical weapons."

Some of the medieval diving helmets and dresses are here illustrated, and it is supposed that these were mainly made of leather. There is a story of a diver at the siege of Bonifacio in 1420, who wore a helmet, and "swimming under water," cut the cables of the enemy's ships. Possibly it was not an ordinary helmet, but a "kettelhatte."

We now arrive at the evolution of the submarine boat. Olaus Magnus, Bishop of Upsala in the sixteenth century, wrote: "There are pirates in Grunland (Greenland?) who make use of skiffs and vessels constructed of leather, for the purpose of going wherever they wish, either above or *below water*, and by their means they pierce and make great holes in passing merchant vessels. In the year 1505 I saw two of these leathern boats or skiffs in the cathedral Church of Aslee, in the western perch. They were dedicated to St. Haluard, and placed there on exhibition, and are said to have been taken by King Haken." The auger was still the weapon of attack employed, and the Swedish naval divers are said to have disabled a big fleet of pirates by its use. In 1559 the Venetians made use of some kind of submarine boat to salve a galleon sunken in the Roads of Malamocco, and in 1578 an English naval gunner, William Bourne, actually designed an apparently practical boat of this class, which he describes in a little work entitled "Inuentions and Deuises." "It is possible," he says, "to make a shippe or boate that may goe under the water unto the bottome, and so to come vp againe at your pleasure." His description is too long for transcription, but an idea may be gained of the boat's probable appearance from the accompanying illustrations. He admitted water into compartments on either side to sink the craft, and pushed the water out again by a species of movable bulkhead when he wanted to come to the surface. When below he drew air through a hollow mast, taking the obvious precaution of sounding to ascertain the depth of water before diving. He mentions no means of propulsion.

Sir William Monson, the famous Elizabethan admiral, propounded the follow-

(*Concluded on page 286.*)

(Concluded from page 285.)

ing scheme of underwater attack: "The greatest shippes in the world," he says, "may be sunk by a barke of 20 tons by this stratagem, viz.: To place a cannon in the hold of a bark with her mouth to the side of the ship, the barke shall board, and then to give fire to the cannon that is stowed under water, and they shall both instantly sink; the man that shall execute this stratagem may escape in a small boat hauled the other side of the bark."

A Scotsman, Napier of Merchiston, about this period published "Four Secret Inventions; besides devices *of sailing under water*, with divers other devices and stratagems for burning of the enemies." Magnius Pegelius is supposed to have constructed some sort of a submarine in 1605. Kessler invented some underwater armor in 1617, and later in the same century Cornelius Van Drebbel—the Hiram Maxim of his age—built a vessel which there seems no reason to doubt was several times navigated below water in the Thames. Even James I., that somewhat timid monarch, is said to have had confidence enough in this boat to intrust his royal person in her on one of her trips. No detailed drawing or description of her is extant, but it appears that she was propelled by twelve oars and carried several passengers besides the rowers. Van Drebbel's great secret was his "chymical liquor," with which he renovated the air on board during submersion. Ben Johnson describes her as "an invisible eel," and

"An automa, runs under water
With a snug nose, and has a nimble tail
Made like an auger,* with which tail she wriggles
'Twixt the costs of a ship and sink it straight."

Papiu's (1692) so-called model of this boat was probably merely his idea of its fresh-air apparatus.

Drebbel was probably the designer of the "water mynes, water petards forged cases to be shot with fireworks, and *boates to goe under water*," which were supplied to Buckingham for the expedition to the Isle of Rhé in 1626, according to official documents, and of the additional "mynes and petards," and "two boates to conduct them under water," which he drew from the government later in the same year. The inventor and his son-in-law, Dr. Knofler, both secured well-paid billets in command of fireships and "engines" in the British navy, and later we find Pepys mentioning in his Diary his "engine to blow up ships," which had "been tried in Cromwell's time," and which he wanted the Admiralty to take up.

Other navies seem to have adopted "water mynes," for in a work on naval architecture published in 1629, it is stated that the Barbary corsairs were acquainted with "submarine torpedoes, which a diver will attach to an enemy's keel." Several persons designed or invented submarine boats and apparatus in the seventeenth century. The priests, Mersenne and Fournier, wrote of a submarine, fish-shaped, with underwater cannon in 1634. Bishop Wilkins in his work on "Mathematical Magick" suggests "an ark for submarine navigation," for use against a "navy of enemies, who by this means may be undermined in the water and blown up." Foulis's "Rotterdam ship that would kill the English under water" is supposed to be De Son's submarine, built in that city in 1640, and of which a drawing is to be seen in the National Library at Paris. It was rectangular, terminated fore and aft by rectangular pyramids, was 72 feet long, 12 feet deep and 8 feet wide. It was strengthened by a girdle of timber faced with iron, and propelled by a paddle-wheel working in a well amidships.

The boats used by the Ukraine Cossacks about this time, which are described by the Sieur de Beauplan as 60 feet long, 10 or 12 feet deep, and surrounded by "bundles of large reeds put together as thick as a barrell from end to end," and "bound with bands made of lime or cherry tree," are claimed by some writers to have been submarines. As a matter of fact, they were merely partially submersible. The crew carried their provisions and stores in watertight cases, and when they wished to escape observation, filled the boat with water. She then sank to the gunwale, but the bundles of reeds kept her from sinking entirely. Space forbids more than the mere mention of many seventeenth and eighteenth century inventions. There was the Marquis of Worcester's "ship-destroying engine," which was merely an infernal machine to be hidden in a ship, though he claims that it could be used as a torpedo "from a mile off." Then there was Borelli's "Navis Urinator," a submarine of 1680, Ciminius's and Deligny's proposed underwater warcraft of 1685 and 1688, Holland's patent for a submarine in 1691, Sir Stephen Evances's and Samuel Wimball's of 1694. In 1715 John Lethbridge invented a submarine vessel something like a closed diving bell. It was a copper cone 6 feet deep with a four-inch glass window and two jointed arms for handling objects below water. Nathaniel Symons, a Devonshire carpenter, ruined himself in building a submarine boat a few years later. He made use of leather bags to raise and sink his boat, squeezing the water out by a species of lever, and made several successful experiments in the River Dart. Days's submarine, which attracted some attention in 1773, should hardly be counted. He merely claimed that he could remain under water for a considerable time in an hermetically sealed box or room built in the center of a small hulk. He went down in Plymouth Sound, and neither he nor his contrivance was ever seen again. One boat only remains to be mentioned before we arrive at Bushnell's famous "turtle," from which modern underwater navigation may be said to date. It is that of the Sieur Denois of Bordeaux, who traveled five leagues under water in it at the mouth of the Gironde in 1772. Unfortunately, no drawing or description of it is forthcoming.

* Is it possible that this "anger" was an early attempt at a propeller?

Reconstruction of the New York Fire Alarm Telegraph System.

(Concluded from page 279.)

contemplated by this proposed plan at once, and it is now receiving the study of the best engineers, in order that the city shall secure not only an adequate but the best possible system. Within three or four months probably some of the new cables will be laid in the streets, new boxes mounted, and the appropriate instruments installed in the present Fire Alarm Telegraph Bureau. The aim will be to substitute the first new cables for the circuits now carried in the cables on the Third and Ninth Avenue elevated railroads, which connect with a large number of boxes, and, as has been stated, are especially liable to injury, on account of the proximity of the third rail and for other reasons. It is probable that with the money now available, new boxes and connections first will be installed on the east side of the city, and then later will be extended as funds are provided.

The greatest care will be manifested in planning the general distribution system, so that the circuits of boxes in adjacent areas will not all be carried by the same cable, whose failure might cut any considerable district.

The proposed scheme it is believed will prove more economical as well as more efficient than the non-interfering successive system with a number of boxes on the same circuit. The paper-insulated cable is estimated to cost about $25 per mile for a pair of conductors, while the rubber-insulated cable required by the higher voltages of the series instruments will cost about $300 per circuit. The

boxes on the single-circuit scheme should not cost more than $50 at the most, while the boxes of approved type for a series circuit would cost $165 each, a maximum number of ten being located on each circuit. This departure from prevailing practice will make the city of New York independent of any system by whomsoever owned or controlled, while the intrinsic merits of the plan have commended it to those engineers by whom it has been examined. It promises to be even more interesting with the development of details now in process of evolution, and the installation of the new system with the fireproof central station in Central Park will add greatly to the fire protection enjoyed by Manhattan Island.

In Brooklyn conditions are also bad, worse even than in New York. Here also a new fire-alarm headquarters is essential. While progress on the plans for improving the fire-alarm telegraph in Brooklyn has not developed as far as in Manhattan, yet it may be said that on account of the extent and less congested charac of much of the borough, the non-interfering successive boxes on a series circuit have been deemed desirable, and doubtless will be adopted in preference to the direct circuits. In the other boroughs also additions and reforms are under way which, once completed, will work for the increased safety of the greater city.

Singing Electric Lamps.

Incandescent electric lamps with metallic filaments sometimes emit musical sounds when they are employed on alternating current circuits. Singing arc lamps have long been known. Even on direct current circuits arc lamps may be caused to sing by the slight rhythmical fluctuations in the current which are produced by the passage of the sectors of the commutator over the collecting brushes. Arc lamps operated by alternating currents often emit low notes, of pitch corresponding with the frequency of alternation. The singing arc has been developed by several experimenters, especially by Poulsen, and adapted to the production of alternating currents of high frequency, for use in wireless telegraphy. Incandescent lamps were supposed to be mute until quite recently, when the Swiss electrician Hohl observed that the metallic filament lamps of a certain establishment emitted a sound, which at times was almost intolerably loud. These lamps were operated by an alternating current of 60 cycles per second. According to Remane, if the natural period of vibration of the metallic filament coincides with the period of alternation of the current the filament is thrown into vibrations of great amplitude, which are transmitted to the bulb by the glass post which supports the filament. A number of singing metallic filament lamps were sent to the testing station of the Society of Swiss Electricians, where they failed to emit audible sounds on alternating current circuits ranging in frequency from 20 to 70 cycles per second, although the filaments were clearly seen to vibrate through a distance of 1/12 to ⅛ inch. It is possible that the transmission of the vibration to the bulb and the production of sound depend on the manner in which the lamp is suspended. M. Gerwer, the chief engineer of the station, concludes that the sound depends on circumstances which vary in different cases and that it can be prevented by changing the method of suspension.—Cosmos.

A large body of iron ore has been discovered in Natal, only thirty miles from the railroad and within a radius of seventy-five miles from the coast. Coking coal has also been located in Natal; limestone has also been found near the ore beds. The river Tegla, which is suitable for the development of hydro-electric power runs through the iron ore property. With everything at hand for the manufacture of iron, these properties will soon be turned to commercial account.

PENNSYLVANIA RAILROAD

Bulletin

ALL-STEEL TRAINS.

The climax in the use of all-steel passenger equipment is the train composed exclusively of all-steel cars.

The first all-steel trains to be operated on regular daily schedules are the

"PENNSYLVANIA SPECIAL"
"24-HOUR ST. LOUIS"
"THE PENNSYLVANIA LIMITED"
"ST. LOUIS LIMITED"
and
"CHICAGO LIMITED"

The first 18-hour train between New York and Chicago, the original 24-hour train between New York and St. Louis, and the pioneer of all "limited" trains, are the first trains to be equipped throughout with all-steel cars.

All-steel trains mean much to passengers.

They mean greater safety, for they are practically indestructible.

They mean additional comfort, for they are heavier and easier riding.

The "Pennsylvania Special" leaves New York at 3.55 P. M. to-day and arrives Chicago 8.55 A. M. to-morrow; it leaves Chicago at 2.45 P. M. and arrives New York 9.45 A. M.

The "24-Hour St. Louis" leaves New York at 6.25 P. M. to-day and arrives St. Louis 5.25 P. M. to-morrow. The "24-Hour New Yorker" leaves St. Louis at 6 P. M. and arrives New York at 7.00 P. M. the next day.

"The Pennsylvania Limited" leaves New York at 10.55 A. M. to-day and arrives Chicago 8.45 A. M. to-morrow; returning it leaves Chicago at 5.30 P. M. and arrives New York at 5.30 P. M. next day.

The "St. Louis Limited" leaves New York at 10.55 A. M. to-day and arrives St. Louis 1.25 P. M. to-morrow. The "New York Limited" leaves St. Louis at 1.02 P. M. and arrives New York 5.30 P. M. the next day.

The "Chicago Limited" leaves New York at 4.55 P. M. to-day and arrives Chicago 4.00 P. M. to-morrow. The "Manhattan Limited" leaves Chicago at 10.30 A. M. and arrives New York 9.30 A. M. the next day.